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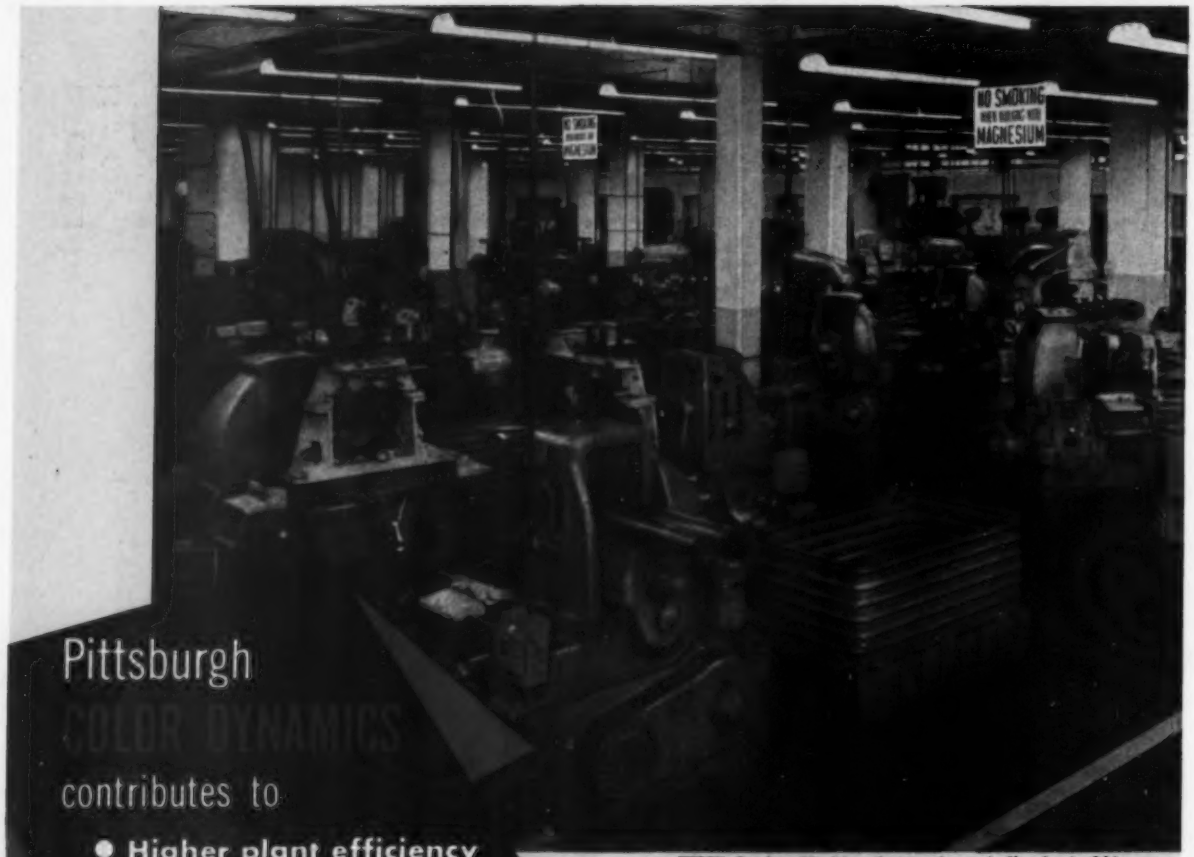
INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

The Shop Teachers' Professional Magazine



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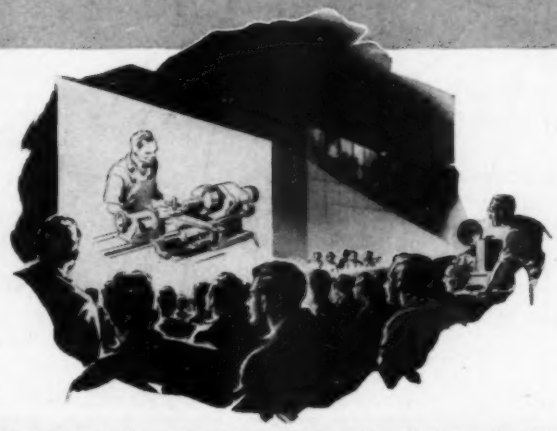
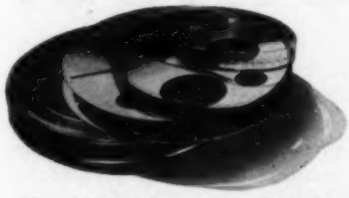


You can accomplish more in less time and with less effort if you use these books and films in your shop classes. They will help you make the work easier and more interesting. Their authenticity and effectiveness are attested by their extensive use in the better schools throughout the United States and at Army, Navy, and Air Force training centers.



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Teaches all basic operations used in machining a shaft held between centers. It shows the use of calipers and micrometers, locating and drilling center holes, selecting cutter bits, facing, rough and finish turning. Showing time, 20 minutes. 16 mm sound film in full color. *Free loan.*

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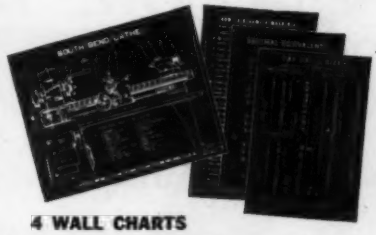

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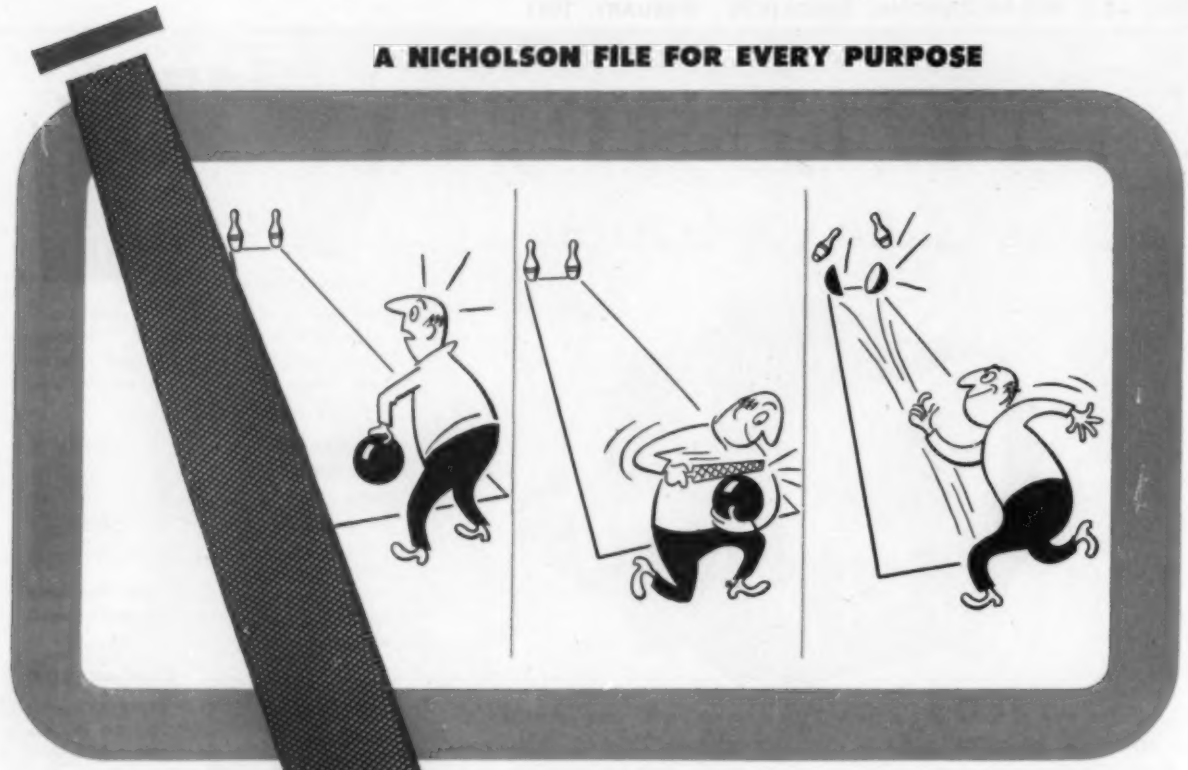

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FEBRUARY, 1951

INDUSTRIAL ARTS *and* VOCATIONAL EDUCATION

THE SHOP TEACHERS' PROFESSIONAL MAGAZINE

Published on the 15th of month preceding date of issue

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This Month's Cover

The cover for the February issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION shows a lumber scaler at work in the Payette National Forest in Idaho.

The picture was taken by W. H. Shaffer. Photograph, courtesy of U. S. Forest Service.

Our Next Issue

The March issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION again will be dedicated to those who must plan and equip school shops.

The "School Shop Annual" which is the name under which the March issue appears, will present the reader with shop layouts, course outlines, articles on shop organization, and equipment and supply lists for metalworking, automotive, electrical, woodworking, printing, and drafting classes.

The issue also will have a number of articles of the problem and project type.

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Editorial Contributions. — The Editor invites contributions bearing upon Industrial Arts, Vocational Education, and related subjects. Manuscripts, drawings, projects, news, etc., should be sent to the Publication Office in Milwaukee. Contributions are paid for at regular space rates. In all cases manuscripts should be accompanied by full return postage.

Articles Indexed. — The articles contained in the Magazine are regularly indexed in "The Readers' Guide to Periodical Literature," and "Education Index."

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ASSOCIATION NEWS

1950 INDUSTRIAL ARTS CONFERENCE

The 37th annual meeting of the Industrial Arts Conference was held at Hotel La Salle, Chicago, Ill., on November 9, 10, and 11, 1950. Dr. Verne C. Fryklund, the chairman, opened the first meeting at 9:30 a.m. on November 9.

Its theme was "Graduate Study With the Major in Industrial Arts." The speakers were L. W. Prakken, *School Shop Magazine*, Ann Arbor, Mich.; Sylvan A. Yager, State Teachers College, Terre Haute, Ind.; and L. L. Gore, Peabody College for Teachers, Nashville, Tenn.

The speakers deplored the fact that the master's degree is becoming little more than a glorified bachelor's degree since many institutions have dropped the thesis and introduced undergraduate laboratory courses for which graduate credit is given. Suggestion was made that no more than 6 credits out of 30 should be given for manipulative courses in graduate work, and then only when the work given is on a higher level.

"Determining and Meeting New Industrial Arts Teacher Training Responsibilities" was the subject discussed at the second meeting, Thursday afternoon.

The speakers were Walter A. Klehm, Eastern Illinois State College, Charleston, Ill.; C. A. Bowman, The Stout Institute, Menomonie, Wis.; and R. H. Larson, State Teacher's College, St. Cloud, Minn.

Some of the responsibilities listed were:

a) Curriculum committee work — horizontal and vertical — for elementary, junior, senior high, and vocational and adult education school

The work for a given city system was outlined.

b) Shop planning, equipment, and maintenance work

c) Sponsoring and conducting industrial-arts workshops for in-service training.

The 9 o'clock Friday morning meeting was devoted to a discussion of "Technical, Professional, and Academic Preparation of Industrial Arts Teachers."

The speakers were H. H. London, University of Missouri, Columbia, Mo.; G. B. Cox, Oregon State College, Corvallis, Ore.; and Amos G. Williams, Southeast State Teachers College, Cape Girardeau, Mo.

There is an extremely wide difference between the industrial-arts offerings in the schools of our country. These offerings differ even between the schools in a single state. A study of 38 teacher training schools showed that the names of courses and departments differed widely.

It was held by those present that four years was too short a time to teach all of the things modern teachers of industrial arts are to know.

The afternoon meeting on Friday was devoted to a consideration of accreditation for instructor training in industrial arts.

The speakers were John F. Friese, Pennsylvania State College, State College, Pa.; G. H. Silvius, Wayne University, Detroit, Mich.; and Gerald Baysinger, Wayne University, Detroit, Mich.

There are many problems that have to be studied before the question of accreditation and standardization for industrial arts teaching practices can be established.

Such items as maximum working stations per shop, the proportion of shopwork to classroom work, the number of reference books and industrial education books to be provided for the teacher training institution library have not yet been established.

The conference went on record as being anxious and willing to lend assistance to The American Association of Colleges of Teacher Education in working out the answers to many of these questions.

The Saturday morning discussion centered about the question of "The General Shop Vs. the Unit Shop in College Teacher Preparation and in the Secondary School."

The speakers were A. B. Mays, University of Illinois, Urbana, Ill.; Ralph W. Whalin, State Teachers College, Richmond, Ky.; and R. M. Stombaugh, State Normal University, Normal, Ill.

The general shop originated at about the same time as the junior high school. It was described, in a general way, as early as 1917, but the name "general shop" first appeared in 1923.

It provides an opportunity for the student to discover his interests and abilities by giving him experiences in a number of industrial activities.

It requires teachers who have a broad industrial background and the ability to do good teaching besides being good organizers.

Institutions training industrial-arts teachers should provide general shop experiences somewhere in their training program.

Unit shops provide greater opportunity for

(Continued on page 6A)

The printers of the Wisconsin Industrial Arts Association at their meeting in Milwaukee, Wis.

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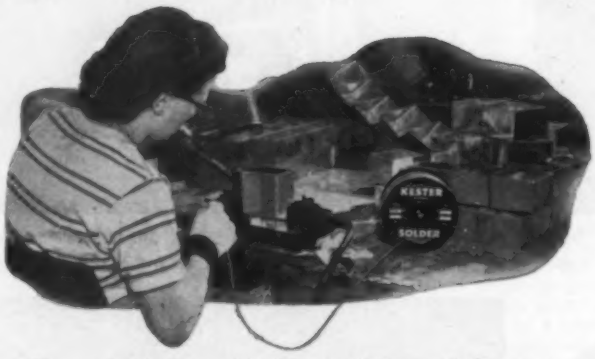

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ASSOCIATION NEWS

(Continued from page 4A)

well-rounded shop programs. They give greater depth, but school population and ability to finance industrial-arts work will have a decisive voice in determining whether industrial arts is to be taught in a unit shop or in a general shop.

The following new members were elected to membership: E. R. Glazener, N. B. Grinstead, Doyle Kemper, and Ralph C. Wenrich.

The 1951 meeting will be held at the La Salle Hotel, Chicago, Ill., on November 8, 9, and 10, 1951.

MASSACHUSETTS INDUSTRIAL EDUCATION SOCIETY BANQUET

The Massachusetts Industrial Education Society will hold its 54th annual banquet at Hotel Shelton, Bay State Road, Boston, on January 20, at 1:00 p.m.

The guest speaker will be F. Kenneth Brasted, director of the Education Department of the National Association of Manufacturers who will present an industrialist's view on "Industrial Arts in America Today."

Invited guests will include Dr. William F. Looney, president of the Boston Teachers' College, Dr. Ellis F. White, president of the Fitchburg Teachers' College, Dr. William Sanders, superintendent of schools in Springfield, John Desmond, commissioner of education in Massachusetts, and Hugh Nixon, executive secretary of the Massachusetts Teachers' Federation.

This annual banquet is attended by industrial-arts teachers representing the entire state.

CALIFORNIA INDUSTRIAL EDUCATION ASSOCIATION

The 1951 spring convention of the California Industrial Education Association has been set for April 13 and 14, at Long Beach. A recent meeting of the CIEA executive council determined that "Safety" would be used as the general theme of the convention. This theme will be carried out in all commercial exhibits. Preconvention committee work will bring safety contributions to this state-wide meeting of shop teachers and administrators.

Dr. Wayne P. Hughes, director of School and College Division of National Safety Council, will be a principal speaker at the convention. Dr. Hughes will also act as a consultant to the various trade area meetings that will be held as a part of the activities.

A charter for each local CIEA chapter is now being developed by the executive council for the dual purpose of definitely identifying each local organization and as an aid in solidifying over-all state organization. The executive council meeting held at Fresno in November was presided over by the new state president, Dale Walfron. Dale is director of Adult and Vocational Education, at Hayward High School.

NORTHEASTERN OHIO INDUSTRIAL ARTS ASSOCIATION MEETING

After a very successful luncheon program in Cleveland in connection with the North Eastern Ohio Teachers Association, the Northeastern Ohio Industrial Arts Association is making plans for a Shop-Centered Program to be held at Ellet High School in Akron, Ohio, January 20, 1951.

The program includes an inspection of the shops, displays and demonstrations based primarily on the place of electricity in the industrial-arts program.

A luncheon will be served in the new high school's cafeteria for those attending the meeting.

This year's association officers are: president, J. H. Detrick, Parma, Ohio; vice-president, J. C. Neff of Cleveland; secretary, M. J. Lerner, Ashland, Ohio; and treasurer, C. E. Riley of Louisville, Ohio.

(Continued on page 22A)

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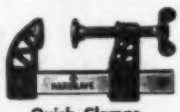

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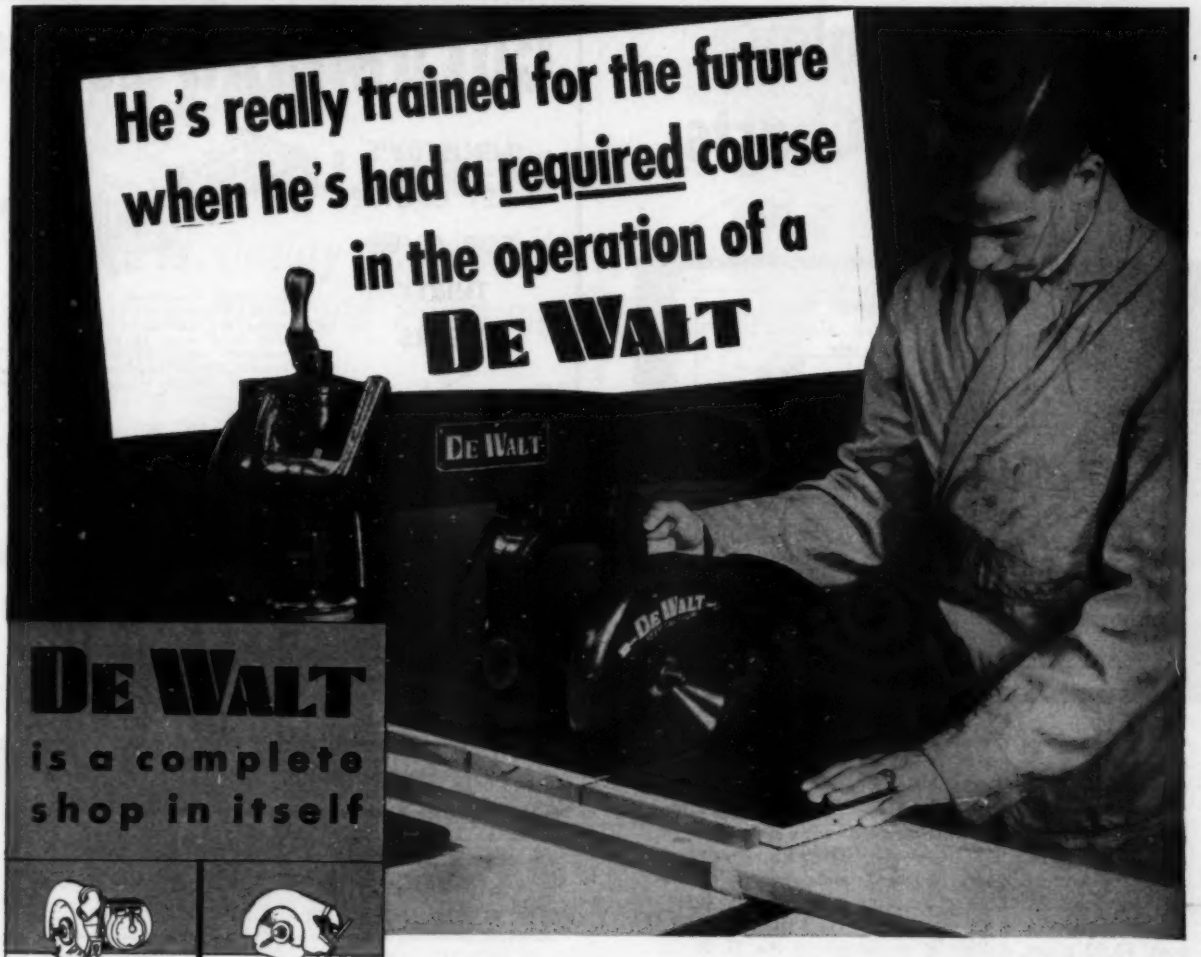
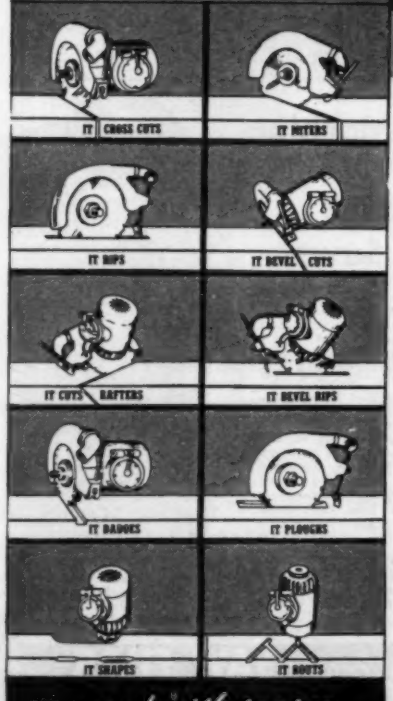
He's really trained for the future when he's had a required course in the operation of a DE WALT



DE WALT is a complete shop in itself



...and with proper tools makes any cut possible!

After the student has completed his basic training course in the use of hand tools, he should have a required course in the operation of De Walt.

Knowing how to make the fullest use of this flexible, easy-to-operate machine, will give any student a head-start as he prepares for tomorrow's industry.

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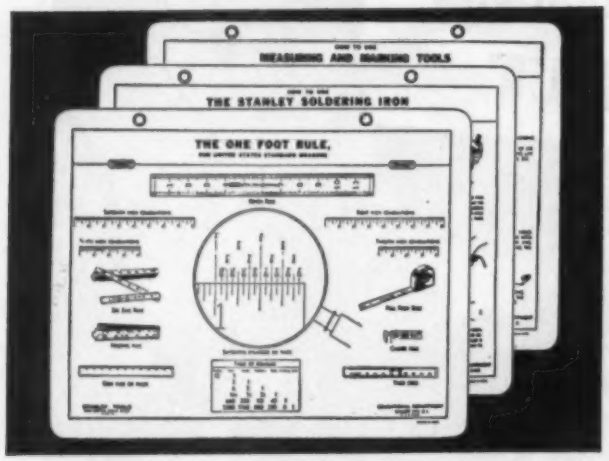
38 CHARTS — 27½″ x 20½″



If you have used Stanley Instruction Charts in your classes, you know they're a big help in teaching proper tool care and use. And now for the first time in almost ten years these charts are available again in a *new* large size. They have been fully revised, with six new ones added. 38 charts in all — they give all the important tool facts for common woodworking and several metal-working tools. And the extra large size, 27½″ x 20½″, makes it easy for a large group to read them. Sold at cost, $5.50 a set, delivered anywhere in the U. S. In Canada, $8.50 postpaid.

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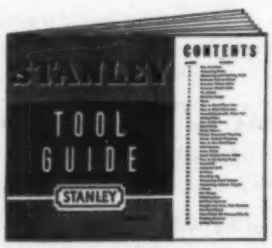

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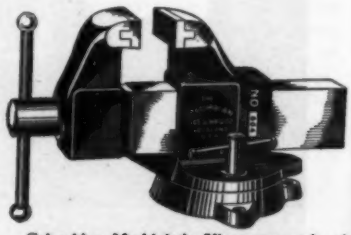

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This ONE Machine
automatically files and joints
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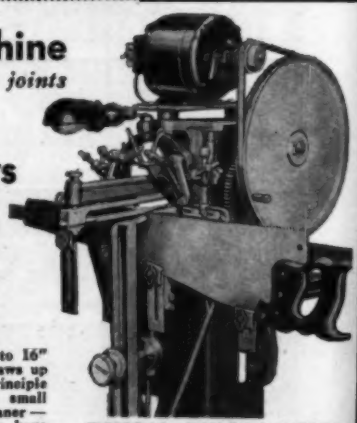

The Foley Saw Filer is ideal for sharpening saws used by students in school shops. It keeps them in tip-top shape, faster and better than by hand filing. Used by Army, Navy, hundreds of manual training departments and industrial plants. The Foley is the only machine that files and joints all hand, back and mitre box saws from 3 to 16 points per inch, crosscut circular saws up to 16" diameter (24" optional), and band saws up to 24′ long. Patented jointing principle automatically evens up large and small teeth, so saws cut faster, truer, cleaner — stay sharp longer. Foley filed saws have less breakage and last longer.

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You may have the privilege of using the Foley Saw Filer in your own shop for 30 days. Write or send coupon for details and list of school users.

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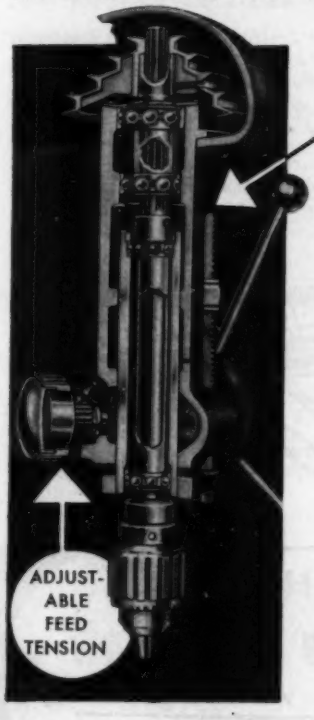

More, good new features are included in Atlas drill presses than any other comparable size drills on the market.

Long accuracy life is assured by the exclusive Atlas "floating drive" with six-splined spindle and steel drive sleeve that floats on *two* ball bearings. *Two more* ball bearings — widely spaced — float spindle free from quill.

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BUSS NO. 208 WOOD PLANER

CAPACITY 20" x 8"

It is the only planer in the low-cost field that is adjusted and operated similarly to the large standard machines used in industry . . . the only planer in this class that is equipped with a sectional infeed roll, sectional Chipbreaker, four driven rolls, in-built knife grinder and other big planer features. The grinder permits the instructor to grind the knives in just a few minutes. It saves a great deal of his time and tends to eliminate the dull knife condition which so frequently prevents the student from doing good work. Engineered for maximum protection, the No. 208, judged from any angle, is the best possible selection for teaching standard wood planing practice in the school shop. And the price is well within the means of the average school budget. Write for the complete facts.

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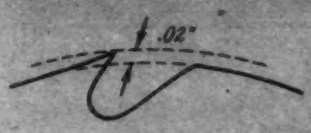

NEW! Safe CIRCULAR SAW BLADE

with many remarkable efficiency features

WHAT THE PTI CUT CONTROL BLADE IS:

Each P T I Saw Blade has only 8 teeth instead of the customary 100. These teeth are entirely different from the conventional saw tooth — they project only 20/1000" above the non-cutting edge. Thus the cut of each tooth is "controlled" by the non-cutting edge, in contrast to the ordinary saw blade where each tooth cuts right down to its base. This relatively simple alteration in design actually works miracles in the performance of the saw blade.

PTI CUT CONTROL

PATENT PENDING

TESTED AND APPROVED

The PTI Cut Control Saw Blade is the first and original blade of this type. It was developed by one of the world's foremost saw manufacturers—and then thoroughly tested in the leading shops and laboratories of Europe and America for more than two years. It is the first saw blade of this kind tested by the Forest Products Laboratories, Madison, Wis., Timber Engineering Company, Washington, D.C., the University of Zurich, Switzerland, and other testing laboratories with favorable reports issued in every instance.

Actual letters from delighted users in America and Europe crowd our files.

Gamble Brothers of Louisville, Kentucky, report.

"We have completed the first phase of the test run on the "Cut-Control" 8-Tooth Carboloy Tipped Rip Saw. This saw was installed in February of this year on a G. M. Diehl Chain Feed Rip Saw and has had a total of 2,037 operating hours, having run on both the day and night shifts. Three hundred and four thousand net feet of dimension lumber was passed over this blade, almost entirely in two species of lumber, oak and hard maple. The thicknesses ranged from 4/4 to 6/4. This saw was only removed from the arbor for washing and occasional hand honing of the carboloy tips. During its entire operation the saw has produced a quality cut suitable for edge gluing."

Takes the DANGER out of circular sawing!

SAVES POWER • CUTS SMOOTHER • LASTS LONGER

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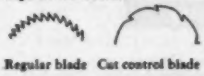
2 Reduced Direct Injuries — Cut Control teeth do not drag the hand into the saw. The non-cutting edge acts as an effective stop to cuts and limits their depth.

3 Cuts Chips — Not Sawdust — Unique cutting action produces chips. Easier to clean. Eliminates fire hazard of spontaneous combustion.

4 30% to 40% Power Saving — Fewer teeth mean fewer cuts to achieve same results — hence less power consumption.

5 Longer Life Without Sharpening — When cutting off chips — the wedge action of the tooth does most of the work — which means less wear on the cutting edge of the teeth.



Regular blade Cut control blade

6 More Efficient Cutting — Each tooth is backed up better against body of blade. It is therefore more rigid, less likely to vibrate — and cuts more smoothly.

7 Quieter Running — Fewer teeth makes saw practically noiseless when running true.

8 Blade Does Not Crack — Blades are made of special Vanadium Steel. In addition — controlling of cut . . . prevents overloading of teeth, a common cause of blade cracking.

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Here are the prices and sizes, delivered, postpaid. All blades are combination rip and cross cut.

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10" diameter blade	$7.50
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(Prices on carbide tipped blades furnished on request.) In ordering, be sure to give the diameter and bore of the blade. Send check or money order or we will ship C.O.D. Satisfaction or money back guaranteed.

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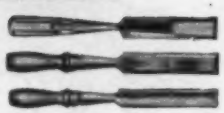

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The GREENLEE line also includes Bit Extensions, Razor-Blade Draw Knives, Ship Augers, Electricians' Bits, Hand Benders for Tubing, Radio Chassis Punches, Knockout Tools and many other timesaving tools for the shop worker and the student.

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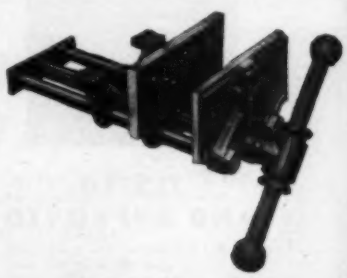

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The right combination of strength and ruggedness, lightness and power, Stanley Electric Drills have many exclusive features for added safety and convenience. All Stanley Drills have three-jaw Jacobs chucks, heat-treated alloy steel gears and universal AC-DC motors for any standard voltage.

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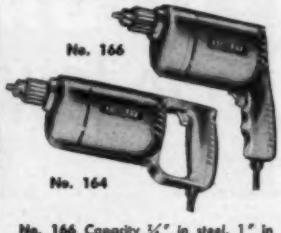

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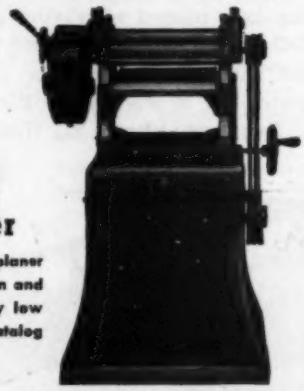
Here is a modernly designed, rugged, high-speed, low-priced planer that is ideally suited for every shop and industrial plant requiring a quality surfacer. The Parks No. 20 Planer has a four-knife cutterhead with a speed of 3600 R.P.M. and offers two feed speeds — 20 and 40 F.P.M., and 40 and 80 F.P.M. Write for complete descriptive literature.



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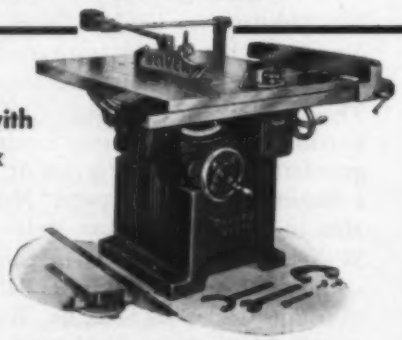
MEDIUM SIZE TILTING ARBOR NO. 270
Saw Bench



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Start your students right! Teach them with this "Oliver"—built for accurate ripping, cross cutting, dadoing, mitering. Table remains level while saw tilts up to 45°. Gauges and table graduated to cut a perfect miter, cut-off to length, or rip to width accurately — no delays for checking measurements. Rips to 16" wide to left of saw, 28" to right. Cross cuts up to 16" wide, 3" thick.

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Ohm's law problems

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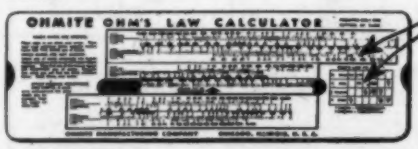

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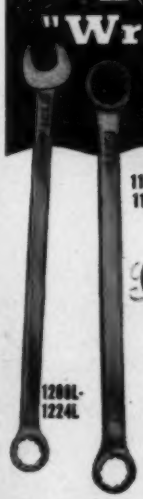

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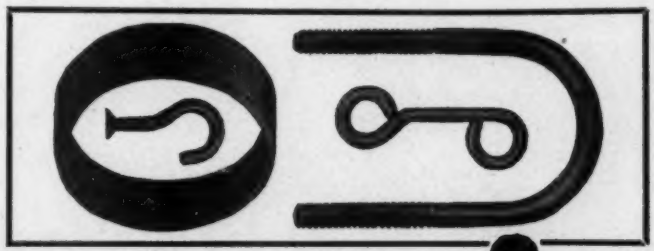

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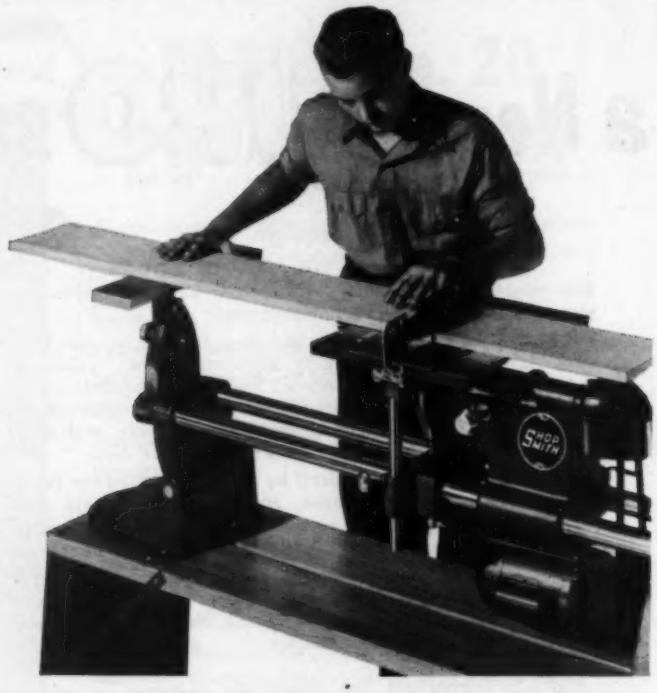

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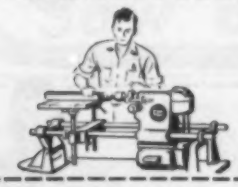

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INDUSTRIAL ARTS *and* VOCATIONAL EDUCATION

FEBRUARY 1951

Teacher Education in Industrial Arts

EMANUEL E. ERICSON
Professor of Industrial Arts
University of California
Santa Barbara College; and
Assistant Director, University Extension
University of California
Santa Barbara, Calif.

Educational programs for the preparation of teachers for industrial arts in the United States have a history of barely fifty years. While some courses were offered by a few schools before 1900, it was not until the first decade of the present century that co-ordinated, independent curricula for teacher education in this field began to bid for recognition.

Since that time the number of institutions and major programs have multiplied manifold, and so have the requirements and course offerings, until there are now more than 175 colleges and universities offering majors leading to the baccalaureate degree as a minimum program for prospective teachers, with an accompanying variety of course offerings both in the technical and craft work and in other phases of the curriculum.

The Investigation

It was for the purpose of obtaining information about the status of present-day teacher education programs in industrial arts that the survey reported upon here was undertaken. The investigation consisted of (1) a personal visit to 26 institutions offering degree majors in industrial arts, and (2) a survey by mail of 28 similar institutions that could not be reached by personal visit because of distance and limitations of time. Out of the latter group 22 completed questionnaires were returned.

In general the attempt was made to consult institutions whose programs are of sufficient size with reference to student groups and equipment to be able to offer a program not too greatly hampered by difficulties coming from too stringent limitation on physical facilities and instructional staff. Geographic distribution and representation from various states were also factors in the selection. The 26 institutions surveyed by personal visit and those from which information was obtained by mail are shown in the following listing:

By Personal Investigation
(In the order visited)

Colorado State College of Education, Greeley
Colorado Agricultural and Mechanical College, Fort Collins
University of Minnesota, Minneapolis
The Stout Institute, Menomonie, Wis.
Bradley University, Peoria, Ill.
University of Illinois, Urbana
Ball State Teachers College, Muncie, Ind.
Ohio State University, Columbus
State Teachers College, California, Pa.
Pennsylvania State College, State College
New York University, New York City
Buffalo State Teachers College, Buffalo, N. Y.
Oswego State Teachers College, Oswego, N. Y.
State Teachers College, Fitchburg, Mass.
State Teachers College, Gorham, Me.
State Teachers College, New Britain, Conn.
North Carolina Agricultural and Mechanical College, Raleigh
University of Florida, Gainesville
Florida Southern College, Lakeland
University of Louisiana, Baton Rouge
Southeastern Louisiana Industrial Institute, Lafayette
Texas Agricultural and Mechanical College, College Station
East Central State Teachers College, Ada, Okla.
Oklahoma Agricultural and Mechanical College, Stillwater
Flagstaff Teachers College, Flagstaff, Ariz.
University of California, Santa Barbara College, Santa Barbara

Information by Returned Questionnaire

Bowling Green State University, Bowling Green, Ohio
Central State Teachers College, Warrenburg, Mo.
East Texas State Teachers College, Commerce, Tex.
Illinois State Normal University, Normal, Ill.
Indiana State Teachers College, Terre Haute, Ind.
Iowa State College, Ames, Iowa
Kansas State Teachers College, Pittsburg, Kans.
Nebraska State Teachers College, Kearney, Neb.
New Jersey State Teachers College, Trenton, N. J.
Oregon State College, Corvallis, Ore.
San Jose State College, San Jose, Calif.
Southern Illinois University, Carbondale, Ill.
State Normal and Industrial College, Ellendale, N. D.
State Teachers College, Mankato, Minn.
State Teachers College, Platteville, Wis.
University of Maryland, College Park, Md.
University of Michigan, Ann Arbor, Mich.
University of Missouri, Columbia, Mo.
Utah State Agricultural College, Logan, Utah
Wayne University, Detroit
Western Michigan College of Education, Kalamazoo, Mich.
West Virginia University, Morgantown, W. Va.

The Questionnaire

The basic instrument for obtaining the desired data was a fairly elaborate questionnaire. This form was also used and marked in connection with personal conferences, in which case the questions could be discussed and elaborated upon to the extent that they would be more meaningful

than the replies made by mail. The information sought in this study was confined to undergraduate programs only, although incidental reference was made in replies and in personal visits to aspects of coordination between undergraduate and graduate programs.

The material on the questionnaire was arranged under four main groupings or sections, as follows:

Section I. Entrance Requirements

Under this section questions were asked concerning (1) stipulations for courses such as mathematics, science, etc., in the high school program of applicants; quality of work stipulated as shown by grade averages; quartile or other groupings; college aptitude examinations; technical examinations; age qualifications, and other possible requirements; (2) the number of high school units or the proportion of the high school program that may be satisfied by drawing and shopwork; (3) whether different standards apply to entrance for industrial arts from those pertaining to the entire school or college; (4) at what point in the college program an applicant is admitted as a major student in the teacher education program in industrial arts.

Section II. Requirements in the Lower Division (the first two years)

Questions under this heading referred to semester or quarter units or hours required in the lower division in (1) liberal arts (academic subjects), under the segregation of English, speech, social science, physical science, biological science, mathematics, and also electives available; (2) technical (skill and craft courses) required or elective in the first two years listed under woodwork, mechanical drawing, machine shop, basic metalwork, electrical work, printing, automobile work, etc.; (3) courses in education, orientation, observation, etc., that were required in the lower division.

Section III. Requirements in the Upper Division (second two years)

In this section many of the questions used under Section II were stated again, with request for listings of requirements and electives in (*a*) academic or liberal arts courses; (*b*) manipulative or laboratory courses in industrial arts; and (*c*) professional courses in methods, content, principles, guidance, student teaching, etc. Here also the request was made for an indication of offerings and requirements in minor fields, including minors in other areas taken by industrial-arts majors, and minors offered in industrial arts for students of other departments.

Section IV. Miscellaneous Information

The principal questions in this section solicited information on (1) conditions under which the skill and craft subjects are taught, with special reference to independent workshops and departmental faculty; (2) organization of the program of student teaching and time schedules involved; (3) programs and procedures in recruiting candidates for the teacher education program.

Summary and Conclusions

The results of the inquiry indicate marked unanimity in basic principles and purposes involved in industrial-arts teacher education. The procedures involved in attaining the desired goals and the allocation of the time of the student for varied activities, however, involve a considerable diversification. In an attempt to classify the reactions, comments and conclusions will be made with reference to the four major sections of the questionnaire.

Entrance Requirements

Approximately 85 per cent of institutions reporting accept high school graduation alone as entrance requirements for the major in industrial arts without stipulating either a pattern for courses and subjects or an attainment shown by grade averages. Among these there is a proportional distribution of all types surveyed, including state and private universities. Some of the reports indicated that state laws make it obligatory in some states that high school graduates be admitted to state-supported institutions of higher learning without restriction. A few colleges admit students on the basis of relative standing in the graduating class.

All but four of the returns gave the information that the department of industrial arts uses the same entrance standards as those used for the entire institution. Exceptions were indicated by two state agricultural and mechanical colleges and two teachers colleges. General college aptitude tests are used in addition to formal entrance requirements in a considerable number of cases, and in a very few instances, special mechanical aptitude tests are used, both presumably for the purpose of record rather than as a means of admission or rejection.

Only in four programs reported are students prohibited from becoming majors in industrial arts in the freshman year. One state university and one state agricultural and mechanical college defer official entrance until the second year, and one state university and one state teachers college do not permit departmental classification until the upper division or the third year.

This question has been one of perennial interest in teacher education and may justify some elaboration here. Some institutions have pressed the policy that students should spend the first two years in taking what some list as general education courses, and that the program should be essentially alike for all students. In this case, departmentalization and specialization would occur in the upper two years.

Those responsible for attempting to turn out efficient teachers in a four-year program, particularly in the various arts, have resisted the plan. Their argument is that in a program such as industrial arts, it is essential that (1) students come under the advisement of departmental personnel as early as possible; (2) that they be permitted to start manipulative and craft work early because of the necessary sequence involved and the need for maturation in connection with performance; (3) that it is not considered possible to obtain sufficient practice and maturity in performance in the third year, plus the necessary professional courses, to be ready to do student teaching in the fourth. To these problems is also added the one of interest in the chosen major line of professional work, which interest may well be discouraged or destroyed if the study program cannot contain a suitable mixture of offerings and if the student is segregated from the advice and encouragement of the desired major department.

Lower Division Requirements

The major reasons for segregating questions under lower division and upper division requirements were (1) to learn to what extent shopwork is taught in the first two years; and (2) to ascertain to what extent future teachers are introduced to the professional phases of the program while in the first two years of the college course. While returns were also obtained from the area of liberal arts or general courses for the lower division, these can more appropriately be discussed under total requirements covered by questions in Section III of the questionnaire. The number of semester units of technical (shop) work allocated to the lower division also will throw further light upon the problem of early opportunities to take departmental courses as discussed in the previous paragraph.

The data furnished indicate that 24 semester units of shopwork are the average for the first two years of the teacher education program, the maximum being 36, and the minimum 6 units. This would indicate that, on the average, more than one half of the work in this area is done in the first two years, and also that in general no crippling restriction is placed upon the departments in arranging a functioning program in the great majority of the institutions reporting. A further support of this statement is the fact that

in only seven cases is the number of units for this area below twenty.

Under professional and pre-teaching assignments no uniform practice can be gleaned from the reports. Thirteen reports include no offerings under this heading in the first two years. All of the others offer some course or courses, educational psychology being listed 5 times, introduction to education 7, and with vocational education, orientation in industrial arts, observation, teaching methods, principles in industrial arts, course construction, and business management in industrial arts receiving not more than 2 mentions each. These courageous few may well be rendering a service in leading the way to a program for making our students "teacher conscious" at an earlier date.

Upper Division Requirements

The more significant items of information brought under this heading in the inquiry so far as this report is concerned may be summarized as follows: (1) Teaching minors in subjects outside of industrial arts are required in only 16 institutions, indicating that this field has come to be considered sufficient as a professional major, and that combinations with physical education or other major areas are less common. (2) The total requirements in the field of liberal arts listed also as general education, including English, social science, physical and biological sciences, physical education, music, art, etc., range from 64 to 21 semester units, with 46 as an average. (3) The total requirements in shop or manipulation subjects, including drawing, vary from 60 to 20 semester units for the degree major, with an average of 38 units. This includes some courses which are interpreted as industrial arts rather than education because they are based on a considerable amount of laboratory work and are usually listed as courses in industrial arts. (Only 6 of the institutions list fewer than 30 semester units.) (4) Vocational education in various forms is offered to industrial-arts majors in 8 institutions, one university requiring 6 semester units of work in this field. (5) Courses in education, psychology, methods, and student teaching, usually listed as professional courses, vary in totals from a maximum of 38 to a minimum of 19 semester units, with an average of 25 units. (6) The credit value of the work in student teaching ranges from 16 to 3 semester units, and only 7 schools report observation as a separate assignment from teaching. (7) Guidance as a separate professional course is taught in 20 of the programs reported, one course of from 3 units to 1 unit being used in all cases. (8) Woodwork and mechanical drawing are the only two shop subjects included in all programs surveyed. (9) Freehand drawing as a separate subject is required in only 14 cases, while industrial-arts design is listed for only 5 institutions. (Could the latter be a part of the reason for the reputation school projects often have of being crude and unfit for use in the home to which the student will proudly bring it upon completion?) (10) The comprehensive general shop has been organized as a part of the preparation of teachers in 9 degree programs, either for basic experience in attaining skills, or as a laboratory for curriculum organization and experimentation in operations not contained in courses more formally organized. (11) Printing (also under the term graphic arts), is offered in 18 institutions either as a required or elective subject. (12) Automotive work is listed as basic for lower division in 7 reports, while there is indication that the so-called *power laboratory* is receiving attention as a substitute, but only in a few places thus far. (13) Other indications of a diversified program are offerings in ceramics, crafts, plastics, weaving, and textiles, art metal, and photography.

Miscellaneous Information

Replies under the section entitled *miscellaneous* indicated that: (1) In 26 institutions industrial-arts shops are available exclusively for the use of the department. These are principally state teachers colleges, although even in some of these, courses in technology and pre-engineering have encroached upon the free use of shops and laboratories. (2) Universities and agricultural and mechanical colleges have customarily either borrowed instruction in skill subjects from engineering departments to a large extent, or borrowed the use of shops for specific periods of time. Both the personal visits and the written reports indicate that more and more of the industrial-arts programs in these schools are able to obtain independent shop and laboratory facilities for the major part of this work; in most instances, however, retaining the opportunities for basic instruction in some of the heavier types of work such as welding, machine shop, etc., for students who require concentrated experience in such fields. There appears to be unanimous agreement that separate working conditions are most desirable for an efficient teacher-education program in industrial arts. (3) Student teaching is almost uniformly carried out in the fourth or senior year. Ten reports indicated that the third year could also be so used. (4) Assignment either in college-attached schools or in local public schools is practiced in 29 programs. Eleven others place the students within fifty miles of the institution, while 10 send their students more than fifty miles away for their student teaching. (5) The question of number of clock hours spent in teaching per semester unit of credit was not clearly answered in many instances, but from information obtained in the personal visits, the average, including required conferences, appears to be approximately 30 clock hours. (6) Teaching assignments vary from one to two semesters, and from one hour per day to a concentrated full-time service for one-half or a full semester. In general the full-time assignment is employed when students are sent so far away that they cannot commute for class instruction at the institution. (7) Twenty-eight reports stated that prospective students are solicited by direct mail to high schools; the same number declared that personal visits to high schools are used; while 21 departments appeal to the alumni for assistance in the selection of candidates, and 12 use no form of publicity for this purpose.

Personal Comments

Impressions and information received from the personal visits to 26 institutions and the mailed responses from 22 others, as well as a comprehensive view of the nationwide program of teacher education, bring into focus some observations concerning the national picture of the teacher-education program. These are here expressed as personal opinions and conclusions.

1. A better qualifed group of students is applying for education as teachers of industrial arts. This is probably due to several causes, including the procedure for selection at the institution.

2. The philosophy of industrial arts in general education is being clarified, particularly in the stronger institutions. Students now being graduated have a better understanding of their position in the educational picture than at any time in the past.

3. The leadership in our teacher education institutions has risen markedly in stature in recent years. While this is not uniform, it is of sufficient frequency to be a cause for encouragement.

4. The faculty of industrial-arts departments in these institutions is rapidly gaining status and, in many instances, can now match or surpass that of other departments in the combination of academic attainment and extramural experience.

5. Analysis and research are being applied to the professional problems in this field that should bear fruit toward efficiency on the one hand and recognition of this

field on the other. Increased effort here will establish industrial arts more firmly as an indispensable part of the program of education.

6. Curriculums for teacher education are under revision in most departments, both large and small, implying the recognition of the need for readjustment and growth.

7. Building programs are planned or under way for a number of industrial-arts departments in colleges and universities. These buildings are receiving the attention of architects and the funds necessary for functional use are being provided.

8. Increasing emphasis is being placed on the preparation of teachers for handling general shops of both the limited and the comprehensive type.

9. There is a growing attempt in most institutions to point the teacher education program toward satisfactory future teacher relationships with adolescent youth rather than solely perfection in skills and technical knowledge.

10. Granted that the three basic phases of preparation of an industrial-arts teacher are (1) ability to do, (2) ability to teach, and (3) social understanding and maturity, the last named is gaining momentum and is given stronger emphasis in many programs.

11. It should not be taken for granted, however, that simply raising the requirements in semester units in social sciences, physical and biological sciences, philosophy, etc., will in itself broaden the desired social understanding of a teacher. The conditions under which courses are taught and the viewpoints of the instructors are important factors.

12. It would be a mistake, however, to conclude that ability in the use of tools and elegance in craft expression should be minimized in favor of *study about* industry and technology, since in this field social and personal growth on the part of adolescent students is evidenced largely through well-planned and well-executed shop and craft projects.

13. If this thought has even a small degree of justification, it would appear that 24 semester units or less in shop and craft work would send the teacher out with great odds against him of being able to do manipulative work of a quality that could be admired and emulated by his pupils.

14. Another factor entering here is the number of clock hours devoted to courses in shops and laboratories in teacher education. This apparently varies from three hours to one and one-half hours of manipulative work as the equivalent of one lecture or classroom hour.

15. There is still resistance in administrative and academic circles in some institutions to the recognition of industrial arts on a par with older and more deeply rooted areas of education. This is apparently true not only from the direction of the so-called academicians, but it also exists, in some instances, in departments of education.

16. Resistance to progress also comes from the fact that teacher education in industrial arts is an expensive program and many institutions which want the program for prestige value or regional pride are unable to provide properly for the requisite laboratories and equipment. One can almost count on the fingers of one hand the institutions which are reasonably well equipped.

17. There is need for greater uniformity in offerings in teacher education programs, even after giving due allowance for regional and local conditions. It appears difficult to justify the differentiation of 60 semester units of skill and craft courses in one institution and as low as 20 units in another, for the undergraduate teacher education program.

18. Further studies need to be undertaken in teacher education in industrial arts, leading to recommendations for minimum requirements and allocations of subjects to the three basic areas in the preparation of an industrial-arts teacher. Perhaps a suitable professional organization or an association of the colleges themselves may bring this about.

Industrial Arts and the 60 Per Cent

DONALD T. WHITNEY
Public Schools
Adrian, Mich.

Probably no recent statement has caused more of a stir among educators than that made by Prosser in the report "Vocational Education in the Years Ahead" (1945). In the form of a resolution it said in part: ". . . We do not believe that the remaining 60 per cent of our youth of secondary school age will receive the life-adjustment training they need. . . ."

Not only have those interested in vocational and industrial education taken to discussing this problem but proponents of so-called general education are beginning to face the facts. All of this sudden interest and concern in this "new" problem is heartening but likewise surprising. Its magnitude can be judged somewhat by the fact that industrial-arts men have been asked to contribute their ideas on the subject to a national committee of the United States Office of Education.

The term and the emphasis may be new but the fact that a large percentage of our pupils were not being educated for "life" was recognized as long ago as 1937 in J. B. Davis's book, *Guidance for Youth.** It is hardly likely that this author was alone in his views or that he was the first and only one to publicize them. Davis wrote, "Much of the failure and disappointment in life and possibly much of the crime that abounds may be attributed to the fact that so large a proportion of our youth go out from our public schools imperfectly prepared to meet the demands of the world in which they find themselves compelled to make some kind of a living. . . . Thoughtful people are seeing that our public school system, as efficient as it may be today, is under some obligation to this vast throng of unfortunates, who may be considered, in part at least, as victims of its neglect."

In shedding new light on what is an old problem let's examine the possibilities of solving it in part, as many have been doing for years, through the medium of

*Published by Ginn and Co., Boston, Mass.

industrial arts. As a starting place and as an anchor to keep us from soaring into academic fantasy, suppose we compare the commonly accepted objectives of industrial arts, the seven cardinal objectives of education as stated by the National Education Association (December, 1928) and the areas of life adjustment education.

Recent literature from the U. S. Office of Education suggests that the schools can offer the greatest life adjustment service to youth in areas of: guidance and pupil-personnel services; ethical and moral living; citizenship; home and family life; self-realization and use of leisure; health and safety; consumer education; tools of learning; work experiences; occupational adjustment and competencies.

The seven cardinal objectives of education were outlined by the N.E.A. over twenty years ago as: health, command of fundamental processes, worthy home membership, vocations, citizenship, worthy use of leisure, ethical character.

Authorities in the field may vary in their concept of the relative importance of the various objectives but they generally agree on the aims and goals of industrial arts. In Lee's book, *Objectives and Problems of Vocational Education*, the chapter on industrial arts which was written by A. H. Edgerton lists 12 objectives. The six which bear directly on areas of life adjustment are: (*a*) to assist in better choice and use of industrial products and services; (*b*) to gain sympathetic attitudes toward other workers and their work; (*c*) to appreciate economic production by firsthand experience with industrial methods; (*d*) to try out individual interests, inclinations, and abilities for industrial pursuits through typical experiences; (*e*) to make reliable studies of the conditions, demands, and opportunities in related occupations; (*f*) to offer greater opportunities for commercial experiences through co-operation with outside productive plants.

Again Selvidge in his chapter headed "The Teacher's Objective" in the book *Industrial Arts in Modern Education* by Bawden and others, states 12 objectives in terms of habits, attitudes, skills, and information. Six of those which are most pertinent to the areas of life adjustment are: To develop in each pupil: (*a*) the ability to select wisely, care for, and use properly the things he buys or uses; (*b*) an appreciation of good workmanship and good design; (*c*) a feeling of self-reliance and confidence in his ability to deal with people and to care for himself in an unusual or unfamiliar situation; (*d*) an attitude of readiness to assist others when they need help and to join in group undertakings; (*e*) a thoughtful attitude in the matter of making things easy and pleasant for others; (*f*) elementary skills in the use of the more common tools and machines in modifying and handling of materials, and an understanding of some of the more common construction problems.

Not only are these objectives part of life adjustment education but they are achieved through handwork which affords an opportunity for the nonacademic learner, as well as adding spice and zest to the fare of the bookish student.

If we compare the common needs of all youth (life adjustment, 1948 version) with the cardinal objective of education (1928) we find that the newer list has omitted "character" and "vocations" and added "guidance and pupil-personnel services." However, the very areas suggested in which the schools can offer greatest service includes "ethical and moral living" which is certainly character. Likewise, "guidance and pupil personnel services and occupational adjustments and competencies" are (or can be) a definite part of "vocations"; just as "safety" may be considered a part of "health teaching."

So, a study of these aims and objectives, both old and new, shows that the needs of our youth have changed very little over the years. True, we see the need for consumer and labor relation education but tucked away in the subheadings of those industrial-arts goals of the past, we find reference to buying wisely and well, co-operation with fellow workers, and respect for the rights of others. The objectives of industrial arts as repeated here is further proof that we have in them the foundation for a practical and concrete education. Further study and thought will show that they are but the specific means for achieving those broader and more general goals of life adjustment.

Industrial arts has lifted itself by its bootstraps out of the dark basement to be on par with some of the loftiest courses. It has done so because it has long recognized and tried to solve some of these life adjustment problems. Industrial arts has always been realistic education. The fact that for years it was (and still is to a lesser extent) the dumping ground for the problem boy is proof that it teaches good social attitudes. The very nature of its activities promotes good work habits, proper social attitudes, and makes for realistic education. There is no single and simple solution to the problem of educating the 60 per cent for *life adjustment* and not every boy and girl can and will benefit from industrial arts; but in any teaching situation we cannot ignore the laws of learning . . . and "learning by doing" is still sound psychology.

The real problem is that we have not progressed much toward the realization of these goals. Perhaps this lack of progress may be the means we have continued to use . . . the traditional academic subjects. We've exchanged our oxcart for a high powered automobile but we're still traveling on logging trails. We don't need a master plan for "life adjustment education" prepared and handed down from above to do a better job of teaching. Neither do we

Ceramics work

Photograph submitted by Robert D. Helsby, industrial arts instructor, State Teachers College, Oswego, N. Y.

need to revolutionize our curriculum or methods of teaching. What we (administrators and teachers) do need is to utilize better what we have — physical setup, equipment, and teaching abilities. To do this requires first, a plain concrete statement of what is to be accomplished; second, an honest desire to achieve; and third, imagination, brains, and drive!

However we look at it and whatever side we favor, Prosser's resolution has done a great service to education, both academic and practical. Objectives and other divisions of learning have their place in the planning and studying of educational processes but the "outcomes" of these efforts is what really counts.

I believe that, O. W. Troutman (deceased) professor of industrial arts at Central Michigan College of Education, summed up the problem when he wrote in the winter issue of the "Vocational News-Bulletin" (1930) that: "Education is primarily preparation for the duties of life. It must be developed from within and not imposed from without, for there can be no education, no change in a human being except as he makes it by his own self-activities. Education is efficient only in proportion as the pupil learns to run under his own power, to get his own facts, to do his own thinking, to carry out his own plans, to check his results, and to correct his procedure. The experiences which a young boy has in working out his own ideas in a school shop under a competent teacher, develop in him the essential characteristic of an educated man — the ability to think through a problem to its end and ultimate use."

Air-Age Education

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Through teaching experiences with the army air force, during the recent war, the writer became familiar with the airplane and its implications and soon afterward became a faculty member in an institution for the education of teachers. It was logical to try to integrate these two interests or professional areas. Thus, the problem of *air-age education at the college for teacher education* was conceived.

Prominent educators have spoken and written much concerning aviation education, but there are few statements available and almost no evidence as to how this work is to be really established and advanced. It seemed necessary to find extensive, pertinent materials for teacher use and statistically significant data to be employed by administrators and curriculum committees.

The value of the project and the report lies largely in the wealth of detail provided for those who would advance aviation education — particularly, through the preparation and upgrading of teachers. The writer is certain that no similar study has been made and he feels that no comparable amount of pertinent and useful materials in the new curriculum area exists elsewhere.

For the purpose of this study, the terms *aviation education* and *air-age education* are considered synonymous and are employed interchangeably in reference to education for the world of today and tomorrow in this realm.

Certain assumptions have been made, among them the writer's belief after an extensive survey of the literature had been completed: education, at any level, should include air-age education as a part of, and aid to, the regular processes of instruction. If a knowledge of aviation and its implications are to be disseminated to the citizens of tomorrow, where better to begin than with potential teachers?

How Investigation Was Conducted

An outline appears here of the procedures employed in this investigation to the end of more readiness for effective work in training institutions and subsequently in school classrooms.

A. A comprehensive canvass of general and special literature in the subject area.
B. Letters of inquiry, as to activities and the availability of materials, sent to these groups:
   1. Member institutions of the American Association of Colleges for Teachers Education..... 258
   2. State departments of education.... 48
   3. Commercial firms and agencies.... 69
   4. Men in strategic positions..... 14
   5. Other selected individuals..... 20
C. The facts thus gained made possible the following investigations:
   1. A study of college offerings as to location, type, content, activity, and means of administration.
   2. The preparation of word lists and later an extended glossary of 446 terms peculiar to the field.
   3. The conduct of an experimental college course of 12 weeks' duration and with 18 men enrolled. This made possible the use of varied methods, activities, and projects and their objective evaluation. A rating sheet was devised so there might be student reactions to the whole course and its parts.
   4. The preparation of an inquiry form, patterned from the data and distributed to a carefully selected jury of experts. Their responses to questions, largely professional, were tabulated and statistically analyzed. Findings, meeting the chi-square test of significance, became the basis upon which the majority of recommendations have been made.
   5. A study of vocational or career possibilities in this new and expanding field in general and as to specific pay-roll positions and jobs.
   6. Preparation of classified lists and a comprehensive bibliography with annotations.

Many respondents indicated a great interest in the study, as evidenced by a high percentage of responses, many requests for summaries, invitations to participate in discussions, etc. The writer was forced to assume that a definite need is felt in the area of aviation education.

Significant Findings

Significant among the findings and recommendations of the related investigations and surveys were:

1. Teacher training is a critical issue in this new area.
2. It is difficult to find teachers with adequate backgrounds.
3. The majority of present teachers in preflight aeronautics have backgrounds in physics, science, and mathematics.
4. Aviation has entered the school curriculum in two forms: in separate aeronautics courses and by the fusion of aviation content into existing courses.
5. Flight experience for both teachers and students is almost universally recommended.
6. A course in aviation, at least one year long, is desirable in the secondary schools.
7. Knowledges and understandings resulting from the study of aviation and its impact on the community are significant in the social studies.
8. Air-age education in the colleges and universities has not declined appreciably since the war and new courses are being added.
9. In 1945 about one half of the 6 million pupils in the 28,000 American secondary schools had access to aviation education.

A review of the literature, general and

special, established the fact that the Aviation Education Division of the Civil Aeronautics Administration is the co-ordinating influence for local, state, and national programs, and that their literature exists in sufficient variety and quantity to provide criteria for all phases of aviation education.

Techniques, methods, and materials for the teaching of aeronautics is an important phase of the literature, as is also the social effects of aviation. Although most of the textbooks of secondary level discuss the technical or semitechnical aspects of aviation, one of the most recent and widely recommended books is a nontechnical, educational document on the integration of aviation content into the elementary and junior high school curricula.[1]

That recent studies have been made at teachers education institutions in co-operation with the American Council on Education and the Civil Aeronautics Administration, is significant for teacher training in aviation education. The unified approach to the solution of educational problems in the air age by the government, the industry, the airlines, the public schools, the institutions of higher learning, and the state departments of education is illustrative of a new spirit in current education and is predicated on the educational philosophy of social dynamics.

Member institutions of the American Association of Colleges for Teacher Education show wide divergence of course offerings, the range being from none to one to eight distinct courses. The teacher training institutions going beyond the summer workshops and general integration in all subjects do chiefly vocational work, that is, they train specialists in aeronautics as well as teachers. The trend is to offer one or two general education courses in aviation and to give flight experience. This present status and trend is borne out by the findings from the inquiry form sent to the jury of experts.

Attempts to Further Aviation Education

State departments of education, in co-operation with the Civil Aeronautics Administrations, and related agencies, are attempting to further the cause of aviation education in the schools through three major activities:

1. In-service training of teachers through summer workshops and short courses during academic years.
2. Encouragement and promotion of aviation education in the public schools, accomplished through published materials, provision of speakers, air-age education displays, and mobile units.
3. Certification of teachers through recognition of required courses in colleges for teacher training.

The leadership in the major educational changes, which are coming about slowly but with emphasis, is being diverted from the local authorities and channeled to the state and federal agencies. The data reveal that the vast amount of teaching materials and aids being disseminated to the classrooms is almost wholly the work of state committees with the assistance of the federal agencies. Very few publications come from the local institutions or individual educators in the field.

Although library sources are relatively weak, numerous free publications and teaching aids are available. The inference may be drawn that interested agencies are making a conscientious effort to assist, with excellent instructional aids and devices, anyone who may be working in the area of aviation education.

In addition to imbuing individuals with the social, political, and geographical implications of the air age, this study takes note of career possibilities that are many and varied. Facts on employment are included which every teacher should know in a general way in order to carry out his guidance responsibilities.

The air force alone employs 586,000 individuals. Of this number 416,000 are officers and airmen while 170,000 are civilians. The airlines have at least 200,000 employees and allied industries have countless thousands on their pay rolls. The figures quoted are not static but alive and advancing.

The glossary represents an effort to bring together words and terms which are being currently used in books and bulletins. The words were collected from 33 sources and the definitions were set by the use of standard dictionaries and the writer's own experiences. If the vocabulary of all teachers were to include the terminology as expressed in the glossary, a large step would be taken in the direction of a comprehensive air-age education program in the public schools.

The activities and projects of the experimental class have been outlined in detail in the body of the report. Facts derived from the 12 weeks of effort by the instructor and students, are given in table form. From the table, a student evaluation form, and class discussions, the following inferences were drawn:

1. A minimum of equipment is needed to initiate a course in aviation education.
2. A diversity of student backgrounds in experiences and scholastic abilities may be expected in this type of class.
3. Probably, because of the interest factor, the students will overachieve in view of other ratings at hand.
4. There is no significant correlation between achievement on psychological and reading tests and success in an air-age course—at least none significant for prediction.
5. There is practically no agreement among students as to which aviation education activities are of the most value.
6. *Aviation fundamentals* is considered of the most value among the specific units of topics.
7. Technical aspects should be minimized in favor of the general education aspects.
8. A large percentage of the class enrollment (88.2 per cent) considered a course of this nature sufficiently important to be required of all students.
9. Approximately 20 students is the appropriate class size, a larger enrollment being likely to make the course unwieldy and ineffective.

An inquiry form was compiled from all previous data collected and sent to a group of 44 educators, carefully selected as a jury of experts. The means of their selection and the validation of the list are explained in the report proper. The range of their opinions on the various questions of the inquiry form was from perfect agreement to almost perfect disagreement. The consensus, however, was that aviation subjects, as such, should be taught only in specialized and vocational situations. The survey, integrated type of course, which includes all subject areas, should be offered to all teachers in training or in service. The latter type of teaching should be done through the fusion of the regular curriculum and by the *institute* or *workshop* approach.

What Statistical Analysis Discloses

Statistical analysis of the jury of experts responses give base for the following specific statements:

1. There is no agreement between experts as to whether a teacher of aviation should be certificated. A positive plurality of opinion was gained but the results were not statistically significant.
2. If certification becomes a requirement, it would be desirable to include the following subjects in a teacher education curriculum:
   a) Aviation fundamentals
   b) History of flight
   c) Meteorology
   d) Social implications of the air age
   e) Geography
3. Being able to pilot a plane is *desirable* as a background for teachers of air-age education.
4. Having ridden in a plane is a *necessity* for teachers of air-age education.
5. A minor *only* in aviation should be offered by colleges interested in the training of aviation teachers.

[1] Stanford University, School of Education, *Aviation Education Source Book* (New York: Hastings House, 1946), 855 pp.

6. No one department of a college is especially prepared to offer the aviation subjects and a combination or co-operation of departments is preferred. The activities, it is suggested, can be co-ordinated through the leadership of one qualified individual.
7. The best method of offering aviation to teachers in service is through institutes and workshops (unanimous decision).
8. The following subjects may well be integrated into existing courses:
   a) History of flight
   b) Human factors in flight
   c) Social implications of the air age
9. As to an aviation curriculum, which could be offered by colleges for teacher education, the following subjects are statistically significant for inclusion:
   a) Aviation fundamentals
   b) Civil air regulations
   c) Air transportation
   d) History of flight
   e) Meteorology
   f) Model building
   g) Navigation
   h) Social implications of the air age
10. A high percentage of agreement was gained as to the departments best prepared to teach individual subjects; these are as follows:
    a) Aerodynamics — physical science
    b) Civil air regulations — social science
    c) Aviation fundamentals — physical science
    d) Air transportation — social science
    e) History of flight — social science
    f) Meteorology — physical science
    g) Model building — industrial arts
    h) Plane recognition — industrial arts
    i) Social implications — social science
11. A significant agreement was reached to the effect that the following five subjects listed may best be taught through a co-operative effort of the two departments named in each case:
    a) Human factors in flight — social and physical science
    b) Navigation — mathematics and physical science
    c) Power plants — industrial arts and physical science
    d) Radio and code — industrial arts and physical science
    e) Structures and systems — industrial arts and physical science
12. There should be no differentiation as to the level, elementary or secondary, at which the following subjects should be taught to teachers:
    a) Aerodynamics
    b) Aviation fundamentals
    c) Civil air regulations
    d) Air transportation
    e) History of flight
    f) Human factors in flight
    g) Meteorology
    h) Model building
    i) Plane recognition
    j) Social implications of the air age
    k) Structures and systems
13. There is no evidence as to which curriculum, elementary or secondary should include these subjects:
    a) Navigation
    b) Power plant
    c) Radio and code

Through the investigations reported in the foregoing, the attempt has been made to offer the interested educator concrete, statistical answers to the oft-repeated question, "What can and should be done in aviation for teacher education?"

Some Leaders in Industrial Education

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(*Continued from page 10 of the January, 1951, issue*)

Legislative Leaders

One of the dramatic moments in the history of industrial education in the United States occurred when the announcement was made at the annual banquet of the old National Society for the Promotion of Industrial Education, in session in Indianapolis, on the evening of February 23, 1917, that the Smith-Hughes Vocational Education Act had been signed that day in Washington by President Woodrow Wilson. This event was the culmination of more than ten years of concerted effort on the part of many organizations and committees, and countless individuals. It was the occasion for jubilant gratification on the part of those fortunate enough to be present, and for nation-wide exultation, as well as for sober reflection upon the responsibility for leadership in new ventures that must be assumed by those who would be charged with the administration of the new law.

Available accounts of this historic decade, 1908–17, give chief emphasis to the activities and contributions of leaders representing business, industry, agriculture, women's clubs, organized labor, and education. Very little is written of the personalities of the leaders in the Congress, without whose active interest and support, and at times strenuous efforts, the goal could not have been reached.

Federal Aid to Education

The success of the campaign for the enactment of the proposed legislation for vocational education hinged directly upon acceptance and approval of the principle of federal aid to the states for the promotion and support of education. This principle is implicit in the provisions of the "Ordinance of 1787," establishing the Northwest Territory. But it is not necessary to go so far back for authority or precedents in considering federal legislation for vocational education.

In building up the case for the ultimate enactment of the Smith-Hughes Law, frequent reference was made to the Morrill Land-Grant College Act of 1862, and the related legislation which followed. The advantages and benefits that accrued from this legislation were dwelt upon at length. It was argued that the experience of more than 50 years of co-operation between the states and the Federal Government pointed the way and insured the success of the proposed legislation for vocational education.

It was argued further that the fact that the Federal Government had done so much for young people who were able to avail themselves of college or university education, made it mandatory that some similar provision should be made for youth who were denied the benefits of college training.

Much depended upon the analogy between the needs of young

men and women of college age, the objectives, the means, and the methods of the Morrill Act, and the corresponding provisions for youth of less than college grade sought under the proposed federal legislation for vocational education. It seems imperative, therefore, that the student of industrial education today have some understanding of the main outlines of this earlier development. To this end I have selected three of the outstanding leaders from the United States Senate and the House of Representatives.

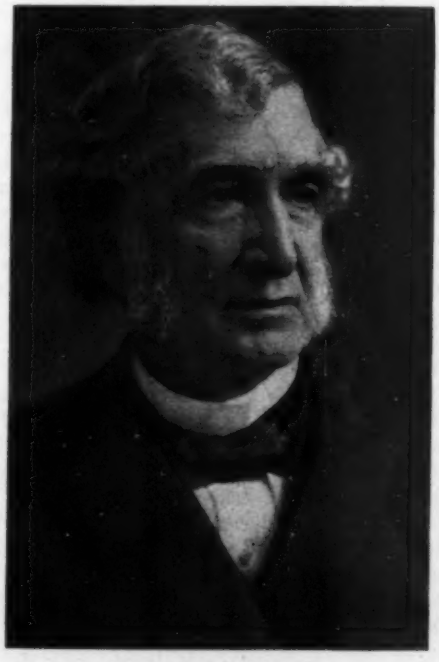
Justin Smith Morrill

The author and sponsor of the Land Grant College Act, Justin Smith Morrill, was born at Strafford, Vt., April 14, 1810; and died at Washington, D. C., December 28, 1898.

He never had the advantages of a college education, and for this reason possibly devoted much time and effort to proposals for providing better opportunities for later generations of young people. He received a good education in elementary and secondary schools, but at the age of 15 years he dropped out of school to take a position as clerk in the village store in Strafford. Foreseeing a future in the business, he spent three years, 1828 to 1831, in Portland, Me., gaining experience in merchandising. Returning to Strafford, he was a partner in the village store from 1831 to 1848, where he prospered as a merchant, and was able to retire in 1848 to a quiet life of reading and farming.

The village store was for him something more than a place of employment and a means of livelihood. He made of it an excellent training school in politics. Beginning in a small way as an amateur politician, he served on county and state committees, and in 1852 he was chosen by the Whigs to represent them at their national convention.

In 1854, he was elected to the U. S. House of Representatives, as an Anti-Slavery Whig. He became an influential member of the important Ways and Means Committee, of which he was chairman for one year, 1865–66. He served in the House from 1854 to 1866; then in the Senate from 1867 until the time of his death, in 1898; "the longest period of continuous service in the Congress" up to that date. "With twelve years in the House and nearly 32 years in the Senate, he was more closely connected with the Congress than any other man of his time." He was frequently referred to in his later years as the "Father of the Senate," and as the "Gladstone of America."



Justin Smith Morrill

Author of the Morrill Land Grant College Act, signed by President Lincoln in 1862. Member of the U. S. House of Representatives from Vermont, 1854–1866; U. S. Senate, same, 1867–1898 — "longest period of continuous service in Congress" to that date. The outstanding success of this venture in "Federal Aid to Education" was an influential factor in securing enactment of the Smith-Hughes Vocational Education Law, in 1917

Before the Civil War he used his influence consistently as an opponent of human slavery, although he was not as rabid as some of the Abolitionists. In the Senate he became a member of the Finance Committee, serving as chairman, 1877–79, 1881–93, and 1895–98. "He found his real work and interest in the study of the tariff and finance."

In 1861, he was author of the Morrill War Revenue Tariff Act, which was an important factor in the financial structure of the government during the war.

Early Beginnings

Senator Morrill was not the originator of the movement for federal aid to the states for the promotion of higher education in agriculture and the mechanic arts, although he is to be credited with leadership in the enactment of the needed legislation. Historians have pointed out that certain significant developments and improvements in public education owe their origin, not to the vision and advocacy of educators, but rather to the demands of businessmen, manufacturers, labor leaders, and others.

This was notably true in the early movement for agricultural and industrial education in which the most potent influence was organizations of farmers. Early examples were the New York Society for the Promotion of Agriculture, organized in 1791, and the Massachusetts Society for the Promotion of Agriculture, organized in 1796. "These societies developed a new literature dealing with current problems, encouraged the establishment of agricultural schools," and brought about the establishment, in 1857, of the United States Agricultural Society, which co-ordinated the activities of numbers of influential organizations, and urged the Congress to make available the proceeds of 500,000 acres of the public lands for the encouragement of agricultural education.

Another important influence on the growing demand for agricultural and industrial training was the establishment of a number of manual Labor Schools in the eastern, southern, and midwestern states. The plan or system of providing earning experiences for students through manual labor was tried out also in a number of literary institutions, "largely through the work of the Society for the Promotion of Manual Labor in Literary Institutions, founded by Theodore Weld in 1831."

These influences, coupled with increasing demands for persons of superior technical training brought about by the rapidly developing industrial and mechanical progress of the country, "made it possible for leaders like Jonathan B. Turner, of Illinois, and Justin S. Morrill, of Vermont, to crystallize this growing sentiment into the passage of the Morrill Act."

Morrill was not successful in his first attempt at federal legislation. In 1857, he introduced in the House of Representatives a bill, "donating public lands to the several states and territories which may provide colleges for the benefit of agriculture and the mechanic arts." This bill was vetoed by President James Buchanan, and it became necessary to start all over again under a new Congress and a new administration.

In the meantime, without waiting for federal legislation, at least three states established institutions, which are still in existence, designed to accomplish the purposes in view, namely: State

College of Agriculture and Applied Science, Lansing, Mich., opened in 1856; Maryland Agricultural College, 1856; and Pennsylvania State College, 1859.

Engineering and Industrial Education

Before the Civil War, leadership in engineering education was provided by a few privately supported institutions — Renssalaer Polytechnic Institute, Troy, N. Y., founded in 1824; Lawrence Scientific School, at Harvard, 1847; Sheffield Scientific School, at Yale, 1860. In addition, excellent training in certain branches of engineering was offered at the United States Military Academy, at West Point, and at the Naval Academy, at Annapolis.

"Although the study of foreign institutions was helpful to some extent, the most important influences (in the development of the colleges of agriculture and the mechanic arts) were those which came from Charles Robert Darwin (1809–82), and his great contribution to biology and to the scientific movement in general, and from Baron Justus von Liebig (1803–73), the eminent German chemist, whose researches in chemistry set the pace for and inspired the activities of many other scientists, which finally culminated in the establishment of the agricultural and engineering experiment stations."

In 1858, Morrill introduced in the House of Representatives the Morrill College Bill, which provided for the creation of institutions of higher learning in the newly settled states. This bill was enacted into law, and, with some supplementary legislation, it resulted in the establishment of about 70 colleges.

The Morrill Land Grant College Act

In 1861, he introduced in the House of Representatives the Morrill Land Grant College Act, giving grants of public lands to the several states and territories which would provide colleges for teaching agriculture and the mechanic arts. This bill was similar in certain respects to the bill of 1858, which was vetoed by President Buchanan. It was approved and signed by President Abraham Lincoln, July 2, 1862.

The act gave to each state 30,000 acres of land from the public domain for each senator and representative. The states within whose borders there was not enough public land received land scrip to make up the balance. The land was to be sold, the proceeds invested, and the income used to create and maintain colleges for the teaching of agriculture and the mechanic arts. Altogether, the states and territories received 11,367,832 acres of land.

In accepting the grants of land, 30 states, mainly in the Middle West, set up new colleges of agriculture and the mechanic arts; 18 states gave the funds to the existing state universities, to be used in financing new or enlarged departments or colleges of agriculture and mechanic arts; in three states the funds were turned over to private colleges.

One of the obstacles in the way of the early development of the land grant colleges was the lack of scientific instruction material. To aid in contributing to the solution of this problem, Congress passed the Hatch Act, in 1887, providing an annual appropriation to each state of $15,000, to be used in research and experimentation.

The second Morrill Act, approved August 30, 1890, provided an additional appropriation to each land grant college of $15,000 annually, to be increased by $1,000 each year for ten years, and to continue thereafter at $25,000 annually. These funds were to be used for adding to permanent endowment and for maintenance.

Under the Adams Act, approved March 16, 1906, the federal subsidies for agricultural research were increased by $5,000 for the fiscal year, 1906, to be increased by $2,000 each year for five years, and $15,000 annually thereafter. Thus, under the provisions of the Hatch Act and the Adams Act each state received $30,000 annually.

Again, in 1908, the annual appropriations for the land grant colleges were increased under the provisions of the "Nelson Amendment" to the agricultural appropriation bill for the fiscal year, 1908. Thus, under the provisions of the second Morrill Act and the "Nelson Amendment" each state received $50,000 annually.

Administration

In comparing the earlier legislation for federal aid with the Smith-Hughes Act, it is to be noted that the first Morrill Act, 1862, carried no provision for either administration or supervision by the federal authorities. "Each land grant college was required to submit to every other land grant college and to the Secretary of the Interior an annual report on its progress and work, and the governor of the state was required to report annually to the Congress on the state of the funds."

The Hatch Act, 1887, gave to the Secretary of Agriculture certain advisory power, but without authority to make advice or suggestions effective. There was still no provision for federal administration or supervision.

The second Morrill Act, 1890, introduced the concept of federal administration. It charged the Secretary of the Interior with the proper administration of the law, and provided that payment to each state by the Secretary of the Treasury was to be made on a certificate issued by the Secretary of the Interior. The president of each institution was required to submit an annual report to the Secretary of the Interior and to the Secretary of Agriculture on the condition and progress of the college.

Under the Adams Act, 1906, the authority of the Secretary of Agriculture was enlarged, and more specific provision was made for the administration of the law by the Secretary.

Co-operation Between State and Federal Governments

The Smith-Lever Agricultural Extension Act, signed by President Woodrow Wilson in January, 1914, carried the principle of federal aid a step further, by providing for co-operation between the states and the Federal Government. Under this Act each state legislature is required to make appropriations to match the federal funds received in excess of $10,000 each year. Further, the projects and plans carried on under the Act must meet the specific approval of the Secretary of Agriculture.

The foregoing brief summary suggests the "Topsylike" manner in which federal legislation has "just growed!"

The administration of the funds appropriated under the Smith-Lever Act is a responsibility of the Secretary of Agriculture. The administration of the land grants under the first Morrill Act, of the funds appropriated under the second Morrill Act and the Nelson Amendment, was originally under the Secretary of the Interior, this function being delegated to the Office of Education. The Office of Education is now a part of the Federal Security Agency, and continues to discharge this function. The administration of federal funds for the aid of agricultural research and for agricultural extension service is a responsibility of the Secretary of Agriculture.

Personal Characteristics

In appearance, Senator Morrill was described as a man of imposing figure; tall and angular; having stern Roman features, and side whiskers. He was not only an eminent statesman; he looked the part.

Notwithstanding the responsibilities he bore, and his stature in the august Senate of the United States, as a man, he was

"characterized by urbanity and charm of manner, modesty, culture, and great love of country." He was affable and approachable.

In addition to his support of legislation for federal aid to and co-operation with the states in promoting education in agriculture and the mechanic arts, Senator Morrill will be remembered for two significant public acts. First, as chairman of the Senate Committee on Buildings and Grounds, he was largely responsible for the completion of the Washington Monument.

While Washington was still president, a movement began looking to the erection of a fitting memorial to the first president of the United States. But, during his lifetime, George Washington successfully opposed the appropriation by the Congress of public funds for this purpose. After his death, in 1799, the proposal was revived, but, becoming involved in petty politics, plans dragged on for years. In 1832, a group of public-spirited citizens took hold, and after years of effort the cornerstone was laid, July 4, 1848. After a few years the funds were exhausted, and construction came to a standstill. Visitors to Washington today may see the place at which the old construction of the shaft ended, and where the new began. Senator Morrill's vigorous sponsorship brought about the completion of the monument, and it was finally dedicated, February 21, 1885.

The second significant achievement for which Senator Morrill will be remembered is the fact that he was largely responsible for the establishment of the Library of Congress, now one of the greatest institutions of its kind in the world. This beginning was brought about also while he was chairman of the Committee on Buildings and Grounds.

(To be continued)

Tests Administered to Apprenticeship Applicants

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Since the close of World War II, employers, apprenticeship advisory committees, labor organizations, and educators have become increasingly concerned with improving the techniques of selecting apprentices for the skilled trades. Some of the factors which have caused this revised interest in selection are: cancellation of many apprenticeship contracts before completion; the increased ratio of applicants to available apprenticeships; the desire of secure journeymen who are of a better quality for the skilled trades; and the desire of the co-operating vocational and adult schools to enroll apprentices who have the necessary capacity to understand the increasing amount of related technical information.

In Milwaukee, the Vocational and Adult Schools, under the directorship of Dr. Wm. Rasche, made its services available to local labor organizations, employers, and the school's advisory committees for giving assistance in the selection of apprentices.

Problems Encountered

With few exceptions, the members of the school's advisory committees and the individual employer and labor representatives were not possessed of personal knowledge of tests and test batteries, nor were they familiar with such terms as, "norm," "percentile rank," "validity," "spatial visualization," etc. Since the hiring of an apprentice from a group of applicants was the responsibility of the trade apprenticeship committee or the individual employer, it was important for the school's representatives to give these individuals an overview of the school's testing service. This was done by including the subject in the agenda of the official advisory committee meetings and by conferring with individual employers and committee members. Copies of the tests which were administered to the apprentice applicants were inspected by the members of the co-operating trade advisory committees. The purpose of each test was fully explained, and the questions concerning it were answered. In addition, the mechanics of referral of applicants to the school was worked out.

Selection of Test Batteries

After a number of conferences with the school's advisory committees and employer and labor representatives, it was agreed that the school's testing service should provide data concerning the general intelligence, mechanical aptitude, manual dexterity, achievement in mathematics, and interests of each applicant for an apprenticeship. It should also provide data concerning personality traits and other special abilities of applicants when requested by the committees or employers. With this background, a trial battery of tests was assembled. The first applicants to whom the tests were administered were referred to the school by the Milwaukee Joint Steamfitters Apprenticeship Committee and the Milwaukee Joint Carpenters Apprenticeship Committee. Subsequently, conferences were held with John A. Kubiak, Supervisor of Occupational Information and Guidance, Wisconsin State Board of Vocational and Adult Education, and representatives of the Vocational and Adult Schools of Wisconsin, at which a number of batteries of tests were assembled for use in selecting apprentices for the trades. As a result of these conferences, and the conferences which were held with the Milwaukee Advisory Committees, the tests listed below were selected as the battery of tests to be administered to all applicants for apprenticeships referred to the Milwaukee Vocational and Adult Schools.

Mental Maturity — "New California Short Form Test of Mental Maturity, Advanced '47 S-Form," Occupational Interest Inventory,

California Test Bureau, 5916 Hollywood Blvd., Hollywood 28, Calif.

Mechanical Aptitude — (Visualization) — "Revised Minnesota Paper Form Board Test, Form MA," Test of Mechanical Comprehension, Form AA, The Psychological Corp., 522 Fifth Ave., New York 18, N. Y.

Achievement in Mathematics — "Milwaukee Vocational and Adult Schools Placement Test in Arithmetic, Form B."

Manual Dexterity — "Purdue Peg Board," Science Research Associates, 228 S. Wabash Ave., Chicago 4, Ill.

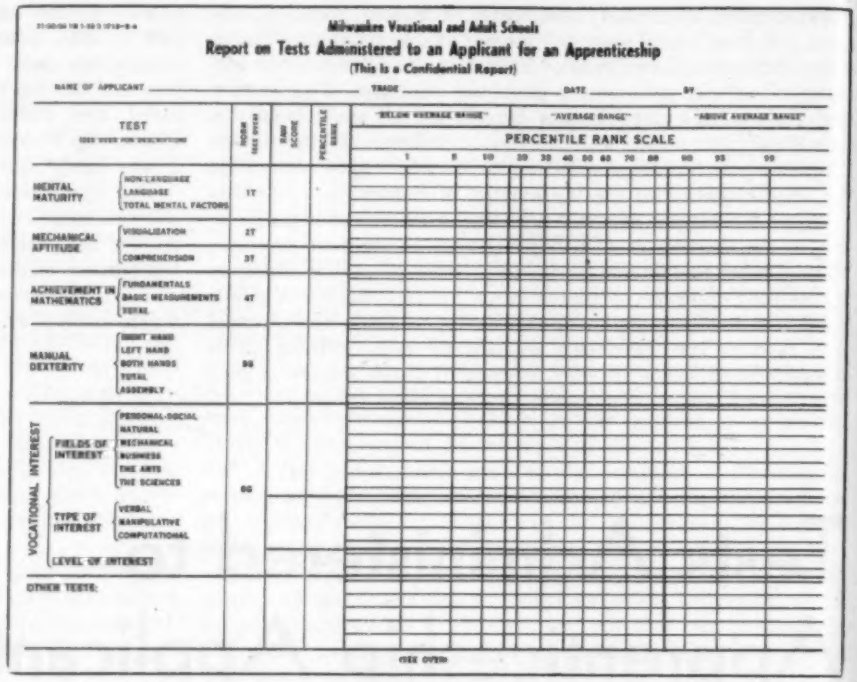
Vocational Interest — "Occupational Interest Inventory — Advanced, Form A."

Development of Local Norms

It was evident from the time the testing service was first made available to the advisory committees and employers that it would be desirable to establish norms for Milwaukee apprentices. It was difficult for committee members to evaluate the performance of an applicant whose test score had been converted into a percentile rank which was based on the performance of nonapprentice groups, such as: high school graduates, engineering freshmen, the general adult population, or some other group. The question was often asked, "How does this applicant compare with the apprentices from our trade?" or "How does he compare with Milwaukee apprentices?"

To overcome these difficulties, tables of norms of mental maturity, mechanical aptitude, and arithmetic achievement were established for the apprentices from each of the following trades: bricklayer and mason, carpenter, electrician, machinist, molder, plumber, sheet-metal worker, steam fitter, and tool and diemaker. A single table of norms was also established on the basis of the sources of all the apprentices from these trades combined. The apprentices whose scores were used to establish the norms were in attendance at the Milwaukee Vocational and Adult Schools during May and June of the school year 1948–49. These apprentices were selected because it was the opinion of the trade instructors and the employer and union representatives that they represented the type of learners who should make desirable journeymen in their respective trades.

In those trade areas where the apprentices were indentured directly to the trade advisory committee, and where the committee hired the apprentices, the names of the apprentices whose scores were used to establish the norms were given to the committees. Since the majority of the apprentices in the group were known personally by the committee members, the comparison of a new applicant with this group, obviously, became very meaningful.



Milwaukee Vocational and Adult Schools

Report on Tests Administered to an Applicant for an Apprenticeship

(This Is a Confidential Report)

NAME OF APPLICANT _____ TRADE _____ DATE _____ BY _____

TEST	NORM TABLE USED	RAW SCORE	PERCENTILE RANK
MENTAL MATURITY — NON-LANGUAGE	1T		
MENTAL MATURITY — LANGUAGE	1T		
MENTAL MATURITY — TOTAL MENTAL FACTORS	1T		
MECHANICAL APTITUDE — VISUALIZATION	2T		
MECHANICAL APTITUDE — COMPREHENSION	3T		
ACHIEVEMENT IN MATHEMATICS — FUNDAMENTALS	4T		
ACHIEVEMENT IN MATHEMATICS — BASIC MEASUREMENTS	4T		
ACHIEVEMENT IN MATHEMATICS — TOTAL	4T		
MANUAL DEXTERITY — RIGHT HAND	5G		
MANUAL DEXTERITY — LEFT HAND	5G		
MANUAL DEXTERITY — BOTH HANDS	5G		
MANUAL DEXTERITY — TOTAL	5G		
MANUAL DEXTERITY — ASSEMBLY	5G		
VOCATIONAL INTEREST — FIELDS OF INTEREST — PERSONAL-SOCIAL	6G		
VOCATIONAL INTEREST — FIELDS OF INTEREST — NATURAL	6G		
VOCATIONAL INTEREST — FIELDS OF INTEREST — MECHANICAL	6G		
VOCATIONAL INTEREST — FIELDS OF INTEREST — BUSINESS	6G		
VOCATIONAL INTEREST — FIELDS OF INTEREST — THE ARTS	6G		
VOCATIONAL INTEREST — FIELDS OF INTEREST — THE SCIENCES	6G		
VOCATIONAL INTEREST — TYPE OF INTEREST — VERBAL	6G		
VOCATIONAL INTEREST — TYPE OF INTEREST — MANIPULATIVE	6G		
VOCATIONAL INTEREST — TYPE OF INTEREST — COMPUTATIONAL	6G		
VOCATIONAL INTEREST — LEVEL OF INTEREST	6G		
OTHER TESTS:			

"BELOW AVERAGE RANGE" | "AVERAGE RANGE" | "ABOVE AVERAGE RANGE"

PERCENTILE RANK SCALE

1 5 10 20 30 40 50 60 70 80 90 95 99

(SEE OVER)

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INTERPRETATION OF TESTS ADMINISTERED TO APPRENTICES

The graphical representation of this applicant's test ratings, as noted in this confidential report, was determined as follows:

Norms

The raw scores on the tests described below are reported in terms of percentile ranks. These ranks are based upon the scores made by one of two groups denoted by the letters "T" or "G." The "T" group is composed of apprentices from the trade which this applicant desires to enter, and who were in attendance at the Milwaukee Vocational and Adult Schools during the school year 1948–49. The "G" group is composed of people from the general population. The tests used are as follows:

Mental Maturity — 1T

The test used was the "New California Short Form Test of Mental Maturity, Advanced '47 S-Form." This test is designed for adults and its two parts are combined to give a measure of the "Total Mental Factors" which are involved in intelligence or mental maturity.

Mechanical Aptitude — Visualization — 2T

The test used was the "Revised Minnesota Paper Form Board Test — Form MA." The test measures the ability to visualize objects in space, a performance which is considered basic to mechanical ability.

Mechanical Aptitude — Comprehension — 3T

The test used was the "Test of Mechanical Comprehension, Form AA." This test is designed to measure the ability to understand the principles and relationships underlying mechanical operations.

Achievement in Mathematics — 4T

The test used was the Milwaukee Vocational and Adult Schools "Placement Test in Arithmetic, Form B." It measures the applicant's knowledge of fundamentals and basic measurements.

Manual Dexterity — 5G

The test used was the "Purdue Peg Board." This is a test of manipulative dexterity. It provides separate measurement of the right hand, left hand, and both hands together.

NOTE: The "Norm Group" is *not* made up of Milwaukee Vocational and Adult Schools apprentices but of typical men applicants for industrial jobs.

Vocational Interest — 6G

The test used was the "Occupational Interest Inventory — Advanced, Form A." The purpose of this inventory is to aid in discovering the basic occupational interests possessed by an individual. The inventory identifies the individual's occupational interests in six major fields as noted. It attempts to determine the "types of interests" — whether verbal, activities which involve facility to use of language; manipulative activities which involve work with materials; or computational activities which require computational ability and skill. The inventory also indicates the level of interest — whether interests are associated with routine tasks, or with tasks requiring considerable skill, or tasks requiring expert knowledge and skill.

NOTE: The "Norm Group" is not made up of Milwaukee Vocational and Adult Schools apprentices but typical adult males in the general population.

Reverse side of report sheet

The Report Form

Since most of the committee members and employers with whom the school cooperated did not have familiarity with standardized tests and the vocabulary of testing, it was highly important to construct a report form which could be easily interpreted by the person receiving it. The individual profile chart was selected because it provides a graphic picture of the applicant as shown by his scores on the tests. Such a special form constructed around a plan of individual profile was therefore developed. See Form 31: OG: 04.

What the tests purport to measure is listed on the form rather than the names of the tests themselves. It was found to be more meaningful to a committee member to think, for example, in terms of an applicant's ability to visualize objects in space as a measure of mechanical aptitude than to interpret the purpose of a test known as the "Minnesota Paper Form Board — Form MA." Since the percentage concept was generally understood by most persons on the skilled trade level, it was decided to convert the raw test scores into percentiles. The space allotted for the construction of the profile was divided into three columns as follows: "Below Average Range," "Average Range," and "Above Average Range." The 16th and 84th percentiles were selected to establish the boundary lines of these three groups. These percentiles were chosen because it was assumed that the apprentices in each trade group which was used to establish the norms was a representative sample of the apprentices from that trade in Milwaukee and that the trait measured was normally distributed. A normal distribution divided into three equal parts will place the upper limit of the lowest group at one sigma distance below the mean and the lower limit of the upper group at one sigma distance above the mean. These points are at approximately the 16th and 84th percentiles.

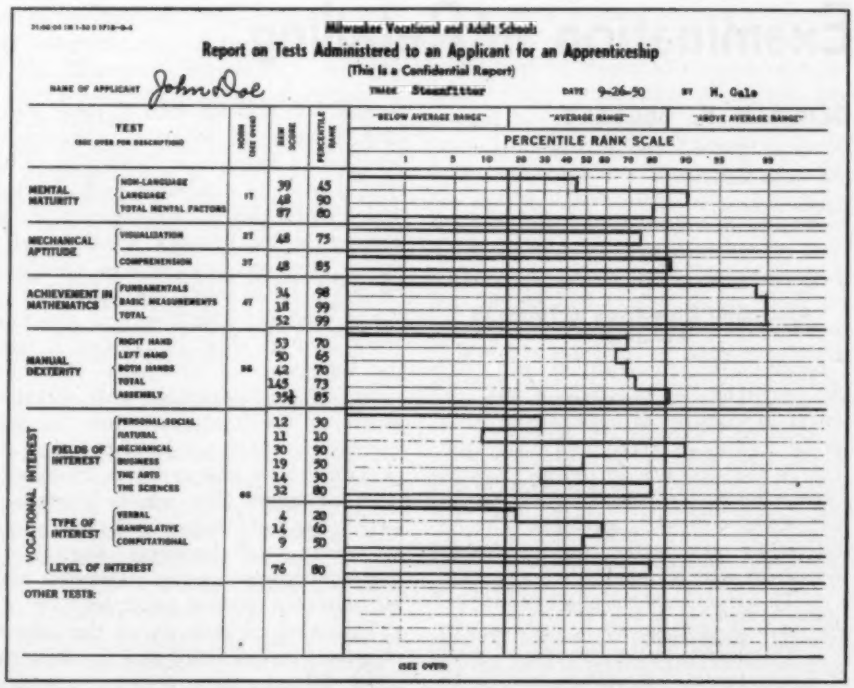
In the conferences which were held with the trade advisory committees to discuss the testing service, it was pointed out that 16 per cent of the apprentices from the group which was used to establish the local norms made scores which placed them in the *Below Average Range* group; another 16 per cent of the same group made scores which placed them in the *Above Average Range;* and the remaining 68 per cent were classified as *Average.* Upon making an appraisal of the apprentices who made up a trade group, the committee members generally agreed that this was a good way to classify the group. It was conceded that many of the apprentices were *Below Average* in their job performance regardless of the fact that they were originally selected by the committee or by the employers. Fine boundary lines printed in the profile space facilitate the construction of the profile. The use of color between these boundary lines results in a bar graph for each of the tests. Since the names of the tests used are not included on the front of the report form, they are listed on the back of the form together with additional information about the interpretation of the tests. See back of Form 31:0G:04.

Significance of the Test Profile

In the advisory committee meetings, the range of prerequisites, such as desirable character traits, interests, physical equipment, and special aptitudes, required of applicants desiring to enter the skilled trades was repeatedly discussed. Because of the complexity of the factors which determine the success of a person in an occupation, it is, consequently, difficult to secure the true measure of the worth of an apprentice on the job, which, in turn, makes the validation of the individual tests of the test battery a difficult task. Since the journeymen from these skilled trades, on the basis of their years of experience, were of the opinion that the aptitudes, achievements, and abilities which we planned to measure with standard tests were significant in the trade, we were justified in using these measuring instruments even if the statistical data on their validity were lacking. When the test profile of a particular applicant was being reviewed by the members of a committee, this question would be asked, "Will this applicant make a good apprentice?" In answering this question it was essential to point out that it is difficult to forecast how successful any individual will be in his chosen vocation because of the complexity of the factors involved in success.

The problem is comparable to that of asking an actuary how long John Doe will live. He cannot tell how long he will live but he can tell rather accurately how many of a large group of John Does will live to be forty or sixty.

It was emphasized that the purpose of the test profile was to provide additional information to supplement the other information which should have been collected on the applicant. The importance of the nontest data, physical equipment, moral equipment, school record, initiative, honesty, etc., was stressed. The appraisal of the applicant by means of the interview technique was emphasized. The answer to the question would be, "On the basis of the information we have, it appears that this applicant will or will not be a good apprentice and we will or will not hire him."



Milwaukee Vocational and Adult Schools

Report on Tests Administered to an Applicant for an Apprenticeship

(This Is a Confidential Report)

NAME OF APPLICANT John Doe TRADE Steamfitter DATE 9-26-50 BY H. Gale

TEST		RAW SCORE	PERCENTILE RANK
MENTAL MATURITY	NON-LANGUAGE	39	45
	LANGUAGE	48	90
	TOTAL MENTAL FACTORS	87	80
MECHANICAL APTITUDE	VISUALIZATION	48	75
	COMPREHENSION	48	85
ACHIEVEMENT IN MATHEMATICS	FUNDAMENTALS	34	98
	BASIC MEASUREMENTS	18	99
	TOTAL	52	99
MANUAL DEXTERITY	RIGHT HAND	53	70
	LEFT HAND	50	65
	BOTH HANDS	42	70
	TOTAL	145	73
	ASSEMBLY	35½	85
VOCATIONAL INTEREST — FIELDS OF INTEREST	PERSONAL-SOCIAL	12	30
	NATURAL	11	10
	MECHANICAL	30	90
	BUSINESS	19	50
	FINE ARTS	14	30
	FINE SCIENCES	32	80
VOCATIONAL INTEREST — TYPE OF INTEREST	VERBAL	4	20
	MANIPULATIVE	14	60
	COMPUTATIONAL	9	50
VOCATIONAL INTEREST — LEVEL OF INTEREST		76	80
OTHER TESTS:			

PERCENTILE RANK SCALE: 1 5 10 20 30 40 50 60 70 80 90 95 99

"BELOW AVERAGE RANGE" | "AVERAGE RANGE" | "ABOVE AVERAGE RANGE"

SEE OVER

Test report sheet with profile

Ethical Practices

The statement, "This is a Confidential Report" is printed at the top of the form. In the conferences which were held with the committees and employers who desired to use the testing service of the school, it was agreed that the test information would be treated confidentially together with the other information which had been gathered about the applicant. It was emphasized that the committee or the employer had the responsibility of informing the applicant that the reason for not indenturing him would not be his failure to pass tests taken at the local Vocational and Adult Schools, but because all of the factual information which had been assembled indicated that he would not be successful in the trade. The co-operating persons were encouraged to refer the rejected applicants to the guidance department of the school for further guidance assistance.

Summary

The purpose of this report is to show how a school can assist co-operating groups in its community by making its special services available to them. The use of the particular service which was described will be continued if it is noted by the co-operating groups that the quality of the apprentices selected is improved. A good start has been made; the school hopes to develop a measure of success on the job so that tests now being used can be validated.

Constructing a Comprehensive Examination in Retailing

DONALD K. BECKLEY
Director, Prince School of Retailing
Simmons College
Boston, Mass.

Analyzing Objectives in Terms of Behavior

Because the investigation in which this comprehensive examination was used sought to identify the objectives in which formal training in retailing was most effective, it was desirable to provide separate subtests for each of the objectives so that part scores could be calculated. The objectives the examination was constructed to measure were as follows:

1. To comprehend the effect of distribution and its cost factors in our economy.
2. To understand the nature and effects of governmental intervention in distributive practices.
3. To interpret data relating to consumer needs and interests.
4. To comprehend and be able to apply principles of intelligent business management as related to store operation.
5. To cultivate skill in using mathematics in the specialized situations which relate to retail store operation.
6. To develop a knowledge of important facts concerning textiles, color and line, display, and fashion, as they relate to retail store operation.

For test construction purposes, it was necessary to examine each of these objectives in terms of behavior, primarily by selecting an appropriate illustration of the type of behavior with which each objective deals. To do this, it is convenient to imagine what the behavior would be of a *successful* as compared with an *unsuccessful* individual in respect to each objective.

For example, objective 4 in the foregoing involves effective thinking through the application of principles. There are many principles of retail store operation governing selection of a store location, effective personnel administration, and the like, which have wide application in specific store situations. The qualified person is aware of and able to apply these principles in solving retail problems, whereas the unqualified person makes judgments without reference to these principles.

This kind of analysis of the selected objectives revealed that the six objectives listed fall into three principal categories of behavior:

1. *The development of effective methods of thinking.* In executive positions in retailing, as in so many other areas of business, the thinking required includes the solving of problems and the meeting of new situations. Effective thinking is needed in retailing to encourage the use of the accumulated experience of the past and to make possible an objective approach to the problems of the present and the future. Specifically, effective thinking as here conceived includes: (1) the ability to formulate reasonable generalizations from specific data, and (2) the ability to apply principles in solving the usual problems.

Generalizing from data involves basically: (1) the ability to perceive relationships in data, and (2) the ability to recognize the limitations of data.[1] In the application of principles in retailing situations, the most important behavior in this area is the correct identification of applications, rather than the recognition of statements of the principles themselves. While principles in the field of retailing are too often neglected, at the same time they cannot be expected to carry the weight given to principles in science, for example. Hence emphasis should be primarily on their specific application.

2. *The acquisition of important information.* The comprehension of knowledge has a place in executive training for retailing, though a less important one than the effective thinking behaviors. Information can more readily be taught on the job than effective thinking, for which the more objective background of the educational institution is better suited. Thus much information concerning retailing need not be presented in college and graduate school. Nevertheless, some types of information must be presented as prerequisite to the more intellectually advanced behaviors. These include the comprehensions needed to understand the status of the consumer in our society, and to handle efficiently the many executive tasks necessary in effective store operation. The acquisition of important information includes primarily the identification of relationship between items of information.

3. *The cultivation of useful skills.* Skill in using mathematics in the specialized situations which arise in store operation is a general requirement for comprehension of retailing activities at all levels. Calculations of selling price and operating figures are made on the basis of an accounting system called the "retail method of inventory," and skill in using this system is needed in all executive work in retailing. The more specific skills needed in various retailing jobs are not included here because they can be: (1) provided at a lower educational level, or (2) learned more readily on the job after a thorough general background has been obtained.

Before considering the selected objectives in terms of content, it is helpful to restate them in terms of the behaviors analyzed above:

1. Development of effective methods of thinking in respect to:
   a) Application of principles of intel-

[1] A comprehensive discussion of this type of analysis of behavior is included in E. R. Smith and R. W. Tyler, *Appraising and Recording Student Progress*, Harper, 1942, Chapter II.

ligent business management in retail store operation.

b) Interpretation of data relating to consumer needs and distribution costs.

2. The acquisition of important information in respect to:
   a) Identification of relationships between items of information, or facts relating to the retailer and to the consumer.
   b) Comprehension of the nature of distribution and of the nature and effect of governmental intervention in retailing.
3. The cultivation of skill in the use of mathematics in retailing situations.

Analysis of Objectives in Terms of Content

The next step in an analysis of objectives is a consideration of content, or the material to which the desired experiences can be applied. To this end, the objectives as restated above should be examined in terms of the areas of content to be covered.

The first type of behavior is the development of effective methods of thinking. This behavior is to be applied in respect to:

a) "Application of principles of intelligent business management in retail store operation."

In applying principles of intelligent business management to retailing situations, it is necessary: (1) to identify correctly statements which through their appropriateness in making predictions or explanations in new situations can be regarded as principles, and (2) to identify correctly statements which are interpretations of principles.

The areas in which these principles of intelligent business management should be applied are as follows: (1) store layout and location, (2) personnel relations, (3) credit procedure, (4) retail salesmanship, and (5) store organization.

b) "Interpretation of data relating to consumer needs and distribution costs."

The data to be interpreted here should appropriately include material on: (1) consumer income, (2) the changing nature of the consuming public as to age or geographic distribution, and (3) the effect of various consumer and business situations on the cost of distribution.

The second type of behavior is the acquisition of important information. This behavior is to be applied through:

a) "Identification of relationships between items of information or facts relating to retailing."

The content here indicated includes: (1) identification of correct definitions of retailing terms, (2) identification of correct and incorrect statements of facts, and (3) identification of qualities pertaining to merchandise. Because the range of merchandise types is so broad, it is not feasible to expect any one retail worker to be familiar with even the major features of all types. It is reasonable to assume that a trained person will have an understanding of the basic merchandise material, textiles, and hence items on textile fabrics have been included here.

b) "Comprehension of the nature of distribution and of the nature and effect of governmental intervention in retailing."

The content included here concerns a definition of "distribution" and comprehension of the nature and effects of governmental intervention in distribution as follows: (1) identification of the most important legislative enactments relating to retailing, (2) comprehension of general trends relating to control of distribution, (3) comprehension of the purposes of the various controls, (4) comprehension of the present status of the "consumer movement," and (5) comprehension of the factors affecting costs in distribution.

The third and final type of behavior to be examined here is the cultivation of skill in the use of mathematics in retailing situations. This includes: (1) actual mathematical computations of the kind needed in store situations under the retail method of inventory, and (2) use of merchandising terms rather than figures in their correct relationships.

Analysis of Objectives in Terms of Situations

Finally, it is necessary to consider the selected objectives in terms of the kinds of situations in which their accomplishment can be measured. Suitable situations must be considered separately for each of the three types of behavior identified earlier.

1. The development of effective methods of thinking in respect to application of principles can be measured directly through presenting to those being examined some actual store problem and requesting an explanation of the principles of operation involved, and the manner in which applications of the appropriate principle can be used to correct the situation. The principal objections to this procedure are these: (1) since the subjects to be examined have had different kinds of retail experience, if any, their reactions to actual situations will be influenced by external circumstances as they exist in their respective organizations, (2) it is difficult to isolate under actual business conditions a situation in which one principle alone applies, (3) in administering an examination to subjects individually or in small groups, it is not feasible to use a real store situation because of the prohibitive amount of time which would be required to study an adequate sampling of situations, and (4) it is not practicable to set up solutions for such situations which can be graded objectively.

Thus an actual working situation in which the subjects would be called upon to work out problems indicating effective thinking is not practicable. A more suitable substitute is a paper-and-pencil test which can make possible the wide variety of situations desirable within a reasonable period of time with the qualifying conditions in each case properly controlled. In selecting situations in which to measure applications of intelligent business management to retail store situations, it is adequate for purposes here to measure ability to identify correct applications of principles. These applications can be set up in the form of true-false or multiple-choice items.

The development of effective methods of thinking in respect to interpretation of data might best be measured through observation by instructors and others who are trained to observe and record such behaviors. This procedure, however, would lack objectivity and would be too time-consuming to be practicable. The most desirable alternative method is the use of a paper-and-pencil test involving the presentation of various sets of data representing the selected content areas. Each set of data, expressed as charts or tables, is followed by a number of statements which purport to be interpretations. The student is asked to indicate his judgment of each of the statements by classifying it as to its relationship to the data. For purposes of this investigation, a three-point scale consisting of "True or probably true," "Insufficient data," and "False or probably false," provides an adequate number of graduations.

2. The second type of behavior, acquisition of important information, concerns identification of relationships between items of information and comprehension of meanings. Exercises of the matching, true-false, and multiple-choice varieties can appropriately be used here.

3. The third type of behavior, the cultivation of skill in the use of mathematics in retailing situations, can be measured through the use of actual problems faced in store merchandising operations. This technique can readily be used in setting up exercises for determining retail price when cost price and mark-up per cent are known, and for similar combinations. In measuring skill in using more involved mathematical concepts, such as open-to-

buy, the arithmetic needed to work out the problem is sufficiently complicated to be more time-consuming than feasible, and makes possible various arithmetic errors which could obscure the actual skill in handling the concepts themselves. Hence for this type of mathematical concept, the terms themselves should be handled through the identification of correct equations.

Examples of Test Situations

The preceding sections preliminary to the actual construction of test items have been included here in detail because they are necessary preliminaries to the actual construction of test items. After these steps had been completed, it was possible to make the items themselves, and examples are included below:

1. *To apply principles of intelligent business management in retail store operation.* The distinction between identification of correct application of principles and mere familiarity with statements of principles may be a fine one, and particular care was necessary here to select only applications. An example, which relates to the principle that retail establishments should locate not in the area of greatest traffic, but in the area in which the greatest number of potential customers will pass, is as follows:

Two types of retail outlet which could most appropriately be located in the immediate vicinity of a railroad station are:

.... *a*) lunchroom
.... *b*) confectionery shop
.... *c*) women's dress shop
.... *d*) auto supplies shop

Similarly, identification of the psychological principle that competition with others is an excellent work incentive which properly administered is measured in this item:

The type of competition usually most stimulating to an employee is that provided by:

.... *a*) his own previous record
.... *b*) the records of fellow employees
.... *c*) a quota set by management

Although the multiple-choice type of item lends itself particularly well to this kind of identification, it was found that in some cases true-false items could be used to advantage. This was particularly true in those situations in which there were only two alternative answers. In measuring this objective there was danger of overlooking the distinction between identification of correct application of principles and mere comprehension of information. One example that measured application of the principle that merchandise customers come to the store specifically to buy should be placed in the less conspicuous locations, whereas good customers may buy without previous thought should be located more conveniently is:

T F Impulse merchandise should be located in a store at points of highest customer traffic.

Another example relates to the principle of business organization that an organizational plan should be set up functionally:

T F In creating a store organization, it is best to build the organization to fit the existing personnel.

2. *To interpret data relating to consumer needs and distribution costs.* As discussed earlier, it was thought desirable to measure ability: (1) to perceive relationships in data, and (2) to recognize the limitations of data. The question of finding suitable subject matter presented a problem, in that it was not desirable to use data which any of those taking the examination had previous occasion to use. At the same time, an effort was made to select data of general application. Because the reading and interpretation of a set of data is time-consuming, it was necessary to limit the number of exercises to as few as was consistent with adequate sampling. The result has been the selection of two sets of data.

The first set of data consists of a statistical table comparing the distribution of families by income classification in 1935 and 1945, from which interpretations are to be made relative to retailing conditions. Among the statements to be classified as "True or partly true," "Insufficient data," or "False or probably false," are:

A majority of consumers in 1945 were able to spend a larger percentage of their income on clothing.

The decrease in numbers of lowest income families and the increase in high income families indicates a leveling-off process that is distributing national income more equitably.

Incomes received in 1945 were higher in dollars than in 1935, but were not actually higher in buying power.

The second exercise consists of three statements regarding population growth in the United States, and statements to be classified include:

The stabilizing of the population will cause the volume of retail business to stop increasing.

A declining population will result in a higher standard of living for all.

There will be less demand for goods and services for children.

In an effort to measure interpretation of data as it relates specifically to distribution costs, another series of statements was developed as an exercise in reasoning. The subject was asked to assume that the statements listed actually were true, and then to reason whether each leads to higher or lower costs of distribution. Among the statements included are:

The inefficient distributors are eliminated.

An unlimited number of distributive outlets is permitted.

Most consumers make purchases in relatively small amounts.

3. *To acquire important information relating to retailing.* The correct identification of definitions of retailing terms was measured through the use of multiple-choice items such as:

The stock turnover:

.... *a*) reflects the relationship of stocks and sales at a given time
.... *b*) reflects the speed with which merchandise moves through a department and is finally sold
.... *c*) is usually calculated for either the beginning or the end of the inventory period
.... *d*) must always be calculated on planned figures.

Open-to-buy is

.... *a*) the same as planned purchases
.... *b*) the same as commitments at retail
.... *c*) the amount of goods that can be purchased for a department during the balance of a given period
.... *d*) the amount of merchandise for which a buyer has contracted during a given period.

Identification of correct and incorrect statements of fact were most readily handled through true-false statements of which the following were examples:

T F Most stores offering charge accounts do not actively encourage credit business.

T F In informal balance, the larger item is farther from the center than the smaller item.

4. *To acquire important information relating to the nature of distribution and of the nature and effect of governmental intervention in retailing.* Two kinds of test items were used here to measure acquisition of information: true-false and multiple-choice. Some general statements relating to the field of distribution were made to be answered either true or false, including these items:

T F The most costly part of the distributive process is retailing.

T F Increased distribution costs inevitably mean increased merchandise costs to the consumer.

T F An agreement by several manufacturers to set the same retail price for their merchandise would legally be considered a valid resale price maintenance agreement.

T F Americans generally have been enthusiastic in supporting consumer co-operatives.

On the other hand, some questions relating to nature and effect of governmental intervention were handled through multiple-choice items, including:

Two groups generally opposed to resale price maintenance legislation are:

.... *a*) chain stores
.... *b*) small independent stores
.... *c*) large department stores
.... d) manufacturers of branded goods

The Robinson-Patman Act was designed to

.... *a*) permit the manufacturer to set retail prices for his goods
.... *b*) prohibit special prices or discounts to distributors not justified by actual savings
.... *c*) prohibit the sale of goods at less than cost
.... *d*) prohibit ownership of distributors' outlets by manufacturers

5. *To cultivate skill in the use of mathematics in retailing situations.* Skill in the use of mathematics in retailing situations was conceived to mean both: (1) skill in the use of numbers in merchandising mathematics calculations, and (2) skill in using mathematical concepts in merchandising situations. Because actual skill in pure arithmetic was not being measured here, simple numerical situations were set up for the actual use of mathematics in order to lessen the likelihood of arithmetical error. Some type of multiple-choice response was considered, but because the examinations could be hand-scored there was no reason to avoid using a fill-in response, and this seemed most appropriate here. The items were set up as follows:

To have a mark-up of 40 per cent at retail, an item costing $2.40 should be sold for $.....

If the retail price of an item is $4 and the mark-up percentage is 45 per cent, the cost price can be no more than $.....

On the other hand, in measuring skill in using the more advanced formulae in merchandising mathematics, the actual working of a problem would be quite time-consuming, and would present the distinct likelihood of error even with simple arithmetic. Hence it was decided to use an objective type of item which could measure identification of correct equations without requiring that they be worked out arithmetically. These were set up in true-false form, the following being examples:

T F The gross margin percentage plus percentage of net cost of merchandise sold equals 100 per cent.

T F Net sales minus operating expenses equals net profit or loss.

T F Book inventory minus physical inventory equals net markdowns.

Details of Test Construction

What materials were used to construct the test items illustrated above? Textbooks, other course materials, course examinations, and conversations with the faculty members teaching the material provided the data from which the items were originally made. An effort was made to avoid using items that students taking the examination had seen previously and might be able to answer correctly merely through recall. The result was a preliminary form of the retailing examination consisting of an accumulation of 196 items. No effort was made to avoid duplication, for this total would be reduced in the process of criticism, and a check on duplication could better be made at a later time.

It was recognized that faculty members of the Prince School of Retailing could be highly useful as test critics, and they were given the preliminary form of the examination and asked to indicate all of the correct answers, if any, and to criticize the items independently. The critics were asked to comment on the items in terms of their wording as well as the extent to which the items measured the objectives set up. When returned, each item on which there had been criticism or on which there was disagreement as to the correct answer was then examined in the light of the following factors: (1) when the critics all agreed on the answer determined by the writer to be correct, was it possible that the item was of too low a level of difficulty? (2) when the critics disagreed, was it a matter of poor wording of the item, or was it an area in which various interpretations were possible? and (3) were the various changes in wording made by some of the critics useful in revising the items? The result was that many items were changed, and others were deleted. These faculty criticisms were relied upon as checks to insure that the examination was adequately valid.

Several entirely new items were devised to measure subject matter areas left uncovered when certain items were deleted, and these were submitted for faculty criticism in the same manner. Finally, the remaining items were checked against a list of kinds of situations and subject matter it had previously been decided should be included. Items for all desired situations were retained, but any remaining duplications were eliminated by selecting the item that best measured the desired material. The reliability of the examination was checked after it had been administered, but because of space limitations the details will not be included here.

This detailed description will suggest the considerable number of details that must be handled if correct principles of test construction are to be followed. Copies of the entire examination are available on request to the writer.

Architecture

Photograph submitted by Robert D. Helsby, industrial arts instructor, State Teachers College, Oswego, N. Y.

Industrial Arts and Vocational Education
John J. Metz, *Editor*

THE FEBRUARY I.A.V.E. NUMBER

The 1951 February issue has again been devoted to tests and testing. A glance at the table of contents shows a number of articles that may be found very interesting and useful to the reader.

Probably the most important one for the teachers of vocational education is A. D. Mathison's contribution, "Tests Administered to Apprenticeship Applicants." This article describes not only what tests to use, but, what is more important, what is to be done with the test results. It must also be remembered that testing is not an end in itself. The results of the test should mean something to the teacher, to the student, and to the future betterment of the course or courses that are being taught.

Beckley's "Constructing a Comprehensive Examination in Retailing" should not be lightly passed up by shop teachers. It is true this examination is not for a shop subject but the article on the construction of the test contains pointers which may be useful to shop teachers as well as to teachers of distributive education.

Sellon's article, "The Importance of Constructing Good Tests," and "Individual Testing in the General Shop" by Burns are written specifically for teachers of industrial arts and vocational education.

Then this testing number presents one final term examination for the general metal class, a test for beginners in printing, one composed of multiple-choice exercises on fastenings, a safety test, and one on aircraft structures.

Readers should not neglect to read E. E. Ericson's article, "Teacher Education in Industrial Arts," which represents the results of his observations made while visiting the teacher education institutions of the United States.

Other noteworthy articles are "Industrial Arts and the 60 Per Cent" by Donald T. Whitney, and "Air-Age Education" by Alan R. Pawelek.

Then there also is another part of Dr. Bawden's series on "Some Leaders in Industrial Education." Incidentally a book by that name has just come off the press. It contains the lives of nine educational leaders in our fields that have appeared as earlier parts of this series, and is published by The Bruce Publishing Company, Milwaukee, Wis.

The February issue also contains about a dozen articles of the problem and project type, an article on "Safety in the Welding Laboratory" by Louis Barocci, and "Teaching Home Maintenance Through the School Shop" by Ernest H. Suerken. Then there also is another part of J. Allen Morris' series on "English for Trade and Vocational Schools."

FOREHANDEDNESS

With the troubles in Korea as an actuality, and with the possibility of still more trouble in Europe, Asia, and elsewhere, one wonders how long it will take before many of the materials and supplies required by the teachers of industrial arts and vocational education will again be restricted for military use only. Other materials will follow as the emergency becomes more acute.

How these restrictions affect the school shop is well known to the teachers who seriously felt the pinch during World Wars I and II.

At present we are all aware that the same conditions may again prevail at a time that is not too far distant. As a matter of fact, we may well borrow the name of one of our popular songs, and say "It's Later Than You Think." With conditions as they are, it is well for shop teachers and their students to prepare for the shortages that are coming. Why not look around right now for things that may be salvaged and used for instructional purposes. The lowly tin can may again become one of the prime sources for the material used in the industrial arts sheet-metal classes. Why not collect them now before they are used for filling up ground depressions or before they are thrown on dump heaps.

Tin smiths and sheet-metal contractors usually have amassed piles of cast-off scrap pieces which they may gladly give to the teacher who asks for them. The same is true of some manufacturers using light band iron, sheet metal, plywood, and plastics.

It may be well to enlist the help of the students and the students' parents in making contacts to get various kinds of materials. After getting this scrap, thought must be given to designing projects that may be made of it.

Although many of the articles now purchased at groceries and other types of stores, come packed in paper cartons, yet many wood boxes are used for packing apples, prunes, oranges, and the like, and many good projects can be made of this salvaged material. It is true, this kind of wood is not the best, but many tool processes can be learned working with it, and it surely is much better than having no wood at all.

Then, too, in many places, native materials of many kinds can be obtained readily. Of course, this may entail some labor to gather it, but it is well to start right now so as not to be caught shorthanded later on. Again the students may be organized to help in collecting such supplies. For those who have access to woods and forests, it may be well to gather material for building rustic furniture for indoor or outdoor use. True, this kind of work may not satisfy the fastidious, but it must not be forgotten that it is merely a method of making the best of an extremely bad condition.

It may also be well to consider the method used in 1942 at the Boys' Trade and Technical High School in Milwaukee, Wis. They found that it would solve the problem of securing materials and give a challenging problem to their students, and at the same time enlist the school in a special way, as a helper to the country in its war-production program. Read an account of how this school helped in a very real way to prepare this country to win a victory over our former enemies. The article appears under the title "The Milwaukee Experiment" on pages 160 and 161 in the April, 1942, issue of this magazine.

The work an unknown good man has done is like water flowing underground, secretly making the ground green.—*Thomas Carlyle.*

For good or ill, your conversation is your advertisement. Every time you open your mouth, you let men look into your mind. Do they see it well clothed, neat, businesslike? — *Bruce Barton.*

The Importance of Constructing Good Tests

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How many of us have joked over our former teachers' tests? We guessed at the methods they used to arrive at final grades, such as (*a*) throwing the papers downstairs and giving A's to those that go to the bottom, etc.; (*b*) weighing the papers to check the amount of graphite that has been spread on them; (c) counting the words; and many other schemes. Has it dawned upon us that our students might be saying the same things about our tests? It is not so much of a joke when it happens to us, or at least it should not be.

Testing should present a serious problem for every teacher, not only because it is a major method of ranking students according to their ability, but because of the effect tests have upon the students themselves. Students regard tests with various reactions, ranging from those with a total disregard of them, believing a test means nothing, up to those who live in mortal fear of a test. We want to get rid of both of these extreme categories and strike a happy medium. This means giving a constructive type of test whereby a student may put forth his best unhampered work, learn something by finding out what he does not know, and give the teacher an accurate comparative grade. To give tests of this type we must have some knowledge of tests and testing.

This does not mean that every teacher must master techniques of tests and statistics until we can figure co-efficients of correlation and regression equations without an error, because in a majority of cases he will never be confronted with such problems. But he should be able to give his students a fair, honest test in the subject he is teaching, and he should correctly be able to compute unbiased comparative grades.

Points to Be Observed

There are certain criteria of the qualities of tests which must be observed by the teacher in order to give a good test. Briefly, these criteria are:

1. Validity — the test should measure what it is supposed to measure; that is, if it is given in a machine-shop subject it should be graded on the student's knowledge of this subject, not on his spelling, English, or drawing.

2. Reliability — the test should be consistent, and the grades should be the same no matter who grades it.

3. Correct level of difficulty — no student should get a perfect score, neither should it be so difficult that it discourages good work.

4. Ease of grading — if a test is difficult to grade, scores will not be consistent, and therefore, inaccurate.

5. Ease of administering — directions should be brief, concise, and easy to follow. Lengthy and confusing directions, oral or written, may cause students to miss questions and ideas they otherwise might know.

The basic principles as well as the details of testing have been written by reliable testing men in magazine articles and books. It would be well worth the time of any teacher to look up some of these articles and books, and get acquainted with the ideas and principles which they contain. They also should become familiar with samples of various forms of test items, and look through the bibliographies listed for further references.

Industrial-arts and vocational teachers have a slight advantage over their academic colleagues, because they may test their students by giving them the conventional paper and pencil test, or they may use performance or practical tests.

Paper and Pencil Tests

The paper and pencil test is the most common type. The teacher makes up questions and statements, and the students write their answers and reactions on the test paper or on a separate answer sheet. Many teachers abuse this test by emphasizing the importance of it, and that it should be prepared for by careful, lengthy study of the subject matter which has been covered. Some of the students take this advice seriously and actually do study for the test, but in turn the teacher spends about half an hour scribbling out the first questions which come to his mind and gives them to his students for the test. On the other hand, there is the teacher who carefully delves through every detail of the course to prepare a good test and comes up with one that would challenge the brain of a specialist. Both of these extremes are an injustice to the students who take the test. A student should be repaid for his study by a fair test, equal to his efforts and progress level.

Preparing a good test is not difficult, but it does require time. Test items may be roughly divided into two categories, recall and recognition. Recall items are those which should be considered important enough to be remembered, and make a direct demand upon the student's memory, as in the sentence completion items. Recognition items are those which are stated, or misstated, as a whole, and make no direct demand upon the student's memory, other than to pick out the correct answer. The true-false, multiple choice, and matching items illustrate this type of item.

To make out such a test it is necessary to go over all reading and lecture assignments, preferably as they are covered in class, and pick out the important points. Possibly only one or two ideas out of each lesson will be important enough to be made into recall items, and the rest will be recognition. A test should be long enough that each item does not count off too much. There should probably be 50 to 100 items. On a longer test the student will be prone to think more of the subject matter than to express personal worry over whether or not he is answering each item correctly. After the items have been gathered, they should be arranged into their various question forms of (*a*) true and false or alternative response; (*b*) multiple choice; (*c*) matching; (*d*) sentence completion, including enumeration; and (*e*) simple recall or direct question. Some students have trouble with certain question forms, and if all forms are included a more reliable score of their knowledge of the subject matter will be obtained. Above each of these forms give brief, concise directions on how the items are to be answered and how they are scored. When the test has been arranged in form, read over the entire test carefully to check the following points:

1. Ease of following directions.
2. Correct grammatical construction of the entire test.
3. That one item does not answer another.
4. That each question has only one correct answer, or that provisions have been made on the key for scoring more than one correct answer.
5. There is sufficient space allowed for writing in the answers to recall items.
6. There are no *trick* or *catch* questions.
7. There are no ambiguous statements.

No matter how careful we are in our own written work, certain vague statements may slip by. It is, therefore, advisable to have someone else who is familiar with the subject matter read the test.

The real test for your work will begin to show when the test is administered to your

class. If few or no students ask "What does this mean?" and "What does that mean?" you can be pretty sure that your items are clear and written on the students' reading level. After the test has been graded, take an inventory to find out how many students missed each item. If an item has been missed by all or practically all of the class, it is probably a poor item, and needs rewording. If the class continually missed items about one phase of the work it would be well to check back on your teaching, as well as the wording of the items. It may be that the former needs some remedial work. By making use of the mistakes you made when constructing the test, and the mistakes the students made when taking the test, you will be able to better both your test building and your teaching of the subject matter.

We have discussed only objective type tests under paper and pencil tests, because they are by far the most important. Subjective or essay type tests do have a place in education but not as a rule in teaching industrial-arts or vocational shopwork and drawing courses. For the average student they are tiresome to take, and for the teacher they are difficult to grade; the resulting grades are far from reliable in a majority of cases. We can make more mistakes by using essay type tests than by not using them.

It has been found that the reading comprehension of some students is so low that it hampers them when taking paper and pencil tests. It is also difficult or impossible to measure certain knowledge of manipulative skills. To supplement paper and pencil tests, the shop teacher may use the performance or practical test.

Performance Tests

The performance test has been used successfully in teaching shopwork in army and navy classes as well as in school shops. When selecting something for a performance test, the teacher should try to get a small, useful project embodying as many operations that have been mastered as possible. The time allotted to the course would determine the time length on the project. For the average industrial-arts course, the project should consume only one or two periods.

There are many methods and combinations of methods used in grading performance tests. The student should be familiar with your method of grading before the test is given. The student may be given a set amount of time, at the end of which, the project must be handed in; or, preferably, a set average time, beyond which, points are deducted from the final grade. The teacher should watch for poor work habits and tool usage during the test. He may either count off points on the final project grade, or he may only tell the pupil of his mistake at the time he makes it. In grading the finished project the same method should be used as in grading the regular projects of the course. For instance, in grading a performance test in sheet metal, so many possible points would be allotted for each part such as soldering, seaming, wiring, double seaming, general appearance, etc. By using all of these grading methods on a performance test, the student is graded on craftsmanship, working speed, tool usage, and work habits.

All in all, it is not too much trouble to construct these tests. The teacher who does take the time to do a good job helps himself as well as his students in several ways.

1. The individual student finds out where he is weak.
2. The teacher learns the accurate achievement record and class standing for each student, based upon his related knowledge, technical knowledge, craftsmanship, and work habits.
3. The teacher may check his shop and classroom teaching technique to learn where he has failed to get his ideas across, where he has been weak, and where he has adequately completed his teaching job.
4. The teacher may more easily learn how his students differ individually, and which of them require remedial work of various types.
5. The teacher sets up the core for a good reliable, valid test which he may use, with a few changes, each time he teaches the course, thereby saving himself time in subsequent teaching.
6. Last but not least, the teacher has produced a satisfied student because the student feels that he has had a fair deal in his classwork and grading.

Individual Testing in the General Shop

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One of the perplexing problems which arises in the conduct of a general shop program is the necessity for testing individual understandings. This is doubly difficult when one tries to allow for individual differences in interests, rates of learning, and rates of accomplishment. A suggested solution to this problem has been tried with the students in industrial arts at Florida State University and the results seem to indicate considerable merit for the plan.

At the start of each course the pupils make out a plan sheet on which are listed the problems which are to be undertaken, the information to be learned, and the activities to be carried out. Also included are reasons for these choices. Suggested projects are listed to point up the projected learning experiences. These planning sheets are put in student folders for further reference. Each week during the term each student hands in a list of 10 questions based on his experiences of the week. These questions are checked against the planning sheet to see how well the original aims are being met, and also to see the growth of the pupil. The questions are checked for their merit as good questions, since the asking of good questions should be part of the training of industrial-arts teachers. At the end of the term questions are selected from the total list of questions handed in by each student to form a personalized examination. Thus each student will answer questions he has written as an indication of his learning experiences and growing understandings. At any time during the term the teacher will go over the list of questions with each student to clear up any misunderstandings, and group discussions may be held to assist in the learning process.

The values of this type of evaluation experience are manifold. The asking of questions which will summarize one's learning experiences is recognized as good teaching technique. It causes the learner to organize his experiences into that which is valuable and worth remembering. This technique helps emphasize the importance of the learnings which accompany ac-

complishment, and if done on a daily basis, does not work any hardship on the pupil or appear as an unnecessary burden. Another value from this method is the elimination of unfairness in the asking of questions for which the student has no background. The students know the material upon which they will be tested, and this material is a part of their total learning experiences, not "tacked-on" related information for which they see no apparent use, and which they have not learned to apply. These questions also serve as part of the student's permanent record and help the teacher to guide the pupil into experiences which are new, at the same time serving as concrete evidence to the student that he has *passed this way once.*

TESTING AND TESTS

GENERAL METAL — FINAL TERM EXAMINATION

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Texts: Ludwig, O. A., *Metalwork Technology and Practice* (Bloomington, Ill.: McKnight & McKnight).

Jennings, R. E., *Gas and A.C. Arc Welding and Cutting* (Bloomington, Ill.: McKnight & McKnight).

Multiple-Choice Examination: Each of the following statements has five possible answers. One of the five answers is correct. Identify your answer by recording the proper letter in the space provided.

( ) 1. The thickness of the sheet of paper on which this statement is mimeographed is approximately: (*a*) .0005″, (*b*) .010″, (*c*) .003″, (*d*) .105″, (*e*) .030″.

( ) 2. An engine lathe with a four-step cone pulley and back gears has: (*a*) four spindle speeds, (*b*) as high as 24 spindle speeds, (*c*) 8 spindle speeds, (*d*) usually 16 spindle speeds, (*e*) 12 spindle speeds.

( ) 3. Larger sizes of twist drills require a preliminary pilot hole: (*a*) equal in size or larger than the dead center, (*b*) if the motor is not powerful enough, (*c*) if no coolant is used, (*d*) if no oil is used, (*e*) in hardened steel.

( ) 4. Steel letters and numerals should never be used to stamp: (*a*) hardened steel, (*b*) machine parts, (*c*) tools, (*d*) annealed metal, (*e*) alloy steel.

( ) 5. In our shop we usually true the faces of grinding wheels with a: (*a*) worn-out file, (*b*) diamo-carbo dresser, (*c*) Huntington dresser, (*d*) whetstone, (*e*) diamond dresser.

( ) 6. A lathe having a direct, single-belt drive, and whose motor runs 1100 r.p.m. with a pulley of 2-in. dia., drives the headstock spindle whose pulley dia. is 6 in. at the rate of: (*a*) 367 r.p.m., (*b*) 2014 r.p.m., (*c*) 270 r.p.m., (*d*) 1140 r.p.m., (*e*) 484 r.p.m.

( ) 7. The peripheral speed of a 1-in. twist drill revolving at 175 r.p.m. is: (*a*) 46 ft./min., (*b*) 60 ft./min., (*c*) 23 ft./min., (*d*) 55 ft./min., (*e*) 38 ft./min.

( ) 8. In foundry practice, small castings usually have the sand and dirt removed and their sharper edges smoothed by means of: (*a*) a portable grinder, (*b*) hand labor, (*c*) a tumbling barrel, (*d*) sand blasting, (*e*) running water.

( ) 9. In drawfiling, it is recommended that one use a: (*a*) mill file, (*b*) pillar file, (*c*) warding file, (*d*) square file, (*e*) three-square file.

( ) 10. Crystalline abrasives are graded according to size by: (*a*) screening the particles through a mesh, (b) gluing the grit to a durable, cloth back, (*c*) gluing the grit to a durable, paper back, (*d*) a skilled metalworker, (*e*) means of a process called lapping.

( ) 11. Pockets of slag in a welded bead may be caused by: (*a*) too much amperage, (*b*) moving the electrode too rapidly, (*c*) using an electrode too small in diameter, (*d*) too little amperage, (*e*) moving the electrode too slowly.

( ) 12. A lathe dog is driven by the: (a) universal chuck, (*b*) carriage, (*c*) tailstock spindle, (*d*) faceplate, (*e*) cross feed.

( ) 13. In the field of industrial production, the world's standard of precision measurement: (*a*) is the micrometer caliper, (*b*) are Johannson gauge blocks, (*c*) is the European meter, (*d*) is the British linear foot, (*e*) is the Vernier caliper.

( ) 14. An alloy of 60 per cent copper and 40 per cent zinc is called: (*a*) brass, (*b*) pewter, (*c*) bronze, (*d*) solder, (*e*) German silver.

( ) 15. One can tell whether a twist drill is made of carbon steel or high speed steel by: (*a*) giving it a spark test, (*b*) testing it with a file, (*c*) identifying the manufacturer, (*d*) the shape of the shank, (*e*) the number of flutes.

( ) 16. After grinding, lathe bits should be: (*a*) stropped, (*b*) oilstoned, (*c*) tempered, (*d*) annealed, (*e*) hardened.

( ) 17. Any and all tools and machine parts can be marked by: (*a*) etching, (*b*) stamping, (*c*) painting, (*d*) chasing, (*e*) embossing.

( ) 18. In the metal shop, a fractional measurement whose denominator is in odd numbers should be expressed: (*a*) with a steel rule, (*b*) in terms of an even denominator, (*c*) with a spring caliper, (*d*) with a folding rule, (*e*) in terms of its decimal equivalent.

( ) 19. The Grinding Wheel Manufacturers' Association has standardized the various wheel: (*a*) sizes, (*b*) grades of bond, (*c*) shapes, (d) speeds, (*e*) formulas.

( ) 20. Leather belting should be preserved and kept clean and pliable with: (*a*) mineral oil, (*b*) graphite, (*c*) lard oil, (*d*) neat's-foot oil, (*e*) linseed oil.

( ) 21. To measure very small spaces between two adjacent surfaces, the machinist uses a: (*a*) Vernier caliper, (*b*) depth micrometer, (*c*) feeler gauge, (*d*) hook rule, (*e*) surface gauge.

( ) 22. The unit of electrical power sold by a Public Utility company is: (*a*) the watt-ampere, (*b*) 110 V. 60 cycle a.c., (*c*) the ohms voltage, (*d*) the 220 V. 60 cycle 3 phase a.c., (*e*) the kilowatt-hour.

( ) 23. The nominal diameter of a twist drill is the same as the diameter of the: (*a*) taper shank, (*b*) margin, (*c*) flutes, (*d*) web, (*e*) body clearance.

( ) 24. When filing soft metals one may remove stock most rapidly by using a file whose tooth spacing is classified as: (*a*) round, (*b*) half-round, (*c*) bastard, (*d*) second-cut, (*e*) smooth.

( ) 25. A shaft must fit in a journal with a: (*a*) running fit, (*b*) press fit, (*c*) drive fit, (*d*) shrink fit, (*e*) force fit.

( ) 26. A common cause for dirty, greasy looking work after it has been buffed is: (*a*) the wrong choice of abrasive cake, (*b*) too much compound on the wheel, (*c*) that the buffing wheel had been used on other metal, (*d*) the improper kind of metal, (*e*) too much previous sanding.

( ) 27. In the machine shop the most frequently used hand abrasive is: (*a*) flint sandpaper, (*b*) aloxite cloth, (*c*) wet-or-dry sandpaper, (*d*) steel wool, (*e*) lapping compound.

( ) 28. A pedestal (column) drill press, of the type commonly found in school shops (Walker-Turner, Delta, Atlas), is known as a: (*a*) hand drill, (*b*) radial drill press, (*c*) back-geared up-

right drill press, (*d*) sensitive drill press, (*e*) portable drill press.

( ) 29. Truing work so that it will not wobble in the lathe chuck is accomplished by using a: (*a*) spanner, (*b*) lathe center, (*c*) piece of chalk, or a dial test indicator, (*d*) 60-degree center gauge, or a machinist's level, (*e*) depth gauge, or a hook rule.

( ) 30. The difference between the largest and smallest limits of a dimension is called the: (*a*) allowance, (*b*) limits, (*c*) tolerance, (*d*) dimension, (*e*) accuracy.

( ) 31. The flat ball, beading roller, spoon shape, and diamond point are tools used in: (*a*) embossing, (*b*) knurling, (*c*) straight turning, (*d*) facing, (*e*) metal spinning.

( ) 32. If a ⅛-in. twist drill is revolving at the rate of 1000 r.p.m. while drilling in mild steel, its cutting speed is: (*a*) 48 ft./min., (*b*) 57 ft./min., (*c*) 61 ft./min., (*d*) 33 ft./min., (*e*) 65 ft./min.

( ) 33. A threading die is held in a: (*a*) wrench, (*b*) spanner, (c) chuck, (*d*) stock, (*e*) screw plate.

( ) 34. The cloth-baked abrasives that are used to polish metal by hand may be used most efficiently in the: (*a*) presence of oil, (*b*) presence of water, (*c*) dry state, (*d*) presence of a soluble cutting oil, (*e*) presence of powdered chalk.

( ) 35. A standard machine tool in which the work is mounted on a reciprocating table and in which the cutting bit remains stationary is the: (a) milling machine, (*b*) drill press, (*c*) shaper, (*d*) lathe, (*e*) planer.

( ) 36. Lathe cutting bits are commonly made of: (*a*) carbon tool steel, (*b*) high speed steel, (*c*) forged steel, (*d*) machinery steel, (*e*) chrome-vanadium steel.

( ) 37. In industry, a great disadvantage in using direct current electrical power is: (*a*) the expense in manufacturing d.c. equipment, (*b*) the difficulty of maintaining a uniform voltage at all points in the circuit, (*c*) the large number of transformers required, (d) the danger inherent in d.c., (*e*) that electricians are not properly trained to work with d.c.

( ) 38. A twist drill should be sharpened with the angle of lip clearance approximately: (*a*) 5–10 degrees, (*b*) 18–22 degrees, (*c*) 15–20 degrees, (*d*) 22½–25 degrees, (*e*) 12–15 degrees.

( ) 39. The hammer most frequently used by a machinist is: (*a*) a lead hammer, (*b*) an engineer's hammer, (*c*) a ball-peen hammer, (*d*) a riveting hammer, (*e*) a setting hammer.

( ) 40. Metal pins having preformed heads, but without threads, and which are used to fasten metal parts together by upsetting or mushrooming, are called: (*a*) jam nuts, (*b*) taper pins, (*c*) headless screws, (d) rivets, (*e*) machine keys.

( ) 41. Work that is mounted between lathe centers for straight (cylindrical) turning is securely fastened with: (*a*) a chuck, (*b*) an arbor, (*c*) a dog, (*d*) a C clamp, (*e*) a compound rest.

( ) 42. The operation of machining the surface around a drilled hole to fit the head of a hex-head cap screw is known as: (*a*) reaming, (*b*) countersinking, (*c*) counterboring, (*d*) spotfacing, (*e*) tapping.

( ) 43. The interchangeability of parts manufactured by industry is the result of maintaining: (*a*) good labor relations, (*b*) close tolerances, (*c*) British linear dimensions, (*d*) close allowances, (*e*) mass production.

( ) 44. Grinding wheels which are manufactured with a special bonding clay are said to be: (*a*) vitrified wheels, (*b*) silicate wheels, (*c*) emery wheels, (*d*) elastic wheels, (*e*) clay wheels.

( ) 45. To preserve a metal surface against outdoor weathering, rust, or corrosion, one of the most effective coatings is: (*a*) linseed oil, (*b*) shellac, (*c*) red lead, (*d*) satin varnish, (*e*) tripoli.

( ) 46. A file that is used by locksmiths for key fitting is a: (*a*) half-round file, (*b*) flat file, (*c*) mill file, (*d*) warding file, (*e*) pillar file.

( ) 47. Railroad car wheels are secured to their axles with a: (*a*) shrink fit, (*b*) sliding fit, (*c*) running fit, (*d*) press fit, (*e*) drive fit.

( ) 48. The size of a precision machine lathe is designated by: (*a*) the maximum swing, (*b*) its horsepower, (*c*) the taper number, of its centers, (*d*) the distance between centers, (e) the number of spindle speeds.

( ) 49. An ornamental finish, commonly used by the gauge and instrument maker, is: (*a*) wax, (*b*) smoke finish, (*c*) varnish, (*d*) red lead, (*e*) spot finishing.

( ) 50. The Morse taper drill press spindle is designed to accommodate twist drills having a: (*a*) bit stock shank, (*b*) straight shank, (*c*) taper shank, (*d*) ratchet shank, (*e*) blacksmith shank.

( ) 51. One type of caliper whose measurements can be read from a graduated index is called: (*a*) a gauge, (*b*) a hermaphrodite, (*c*) a spring divider, (*d*) a protractor, (*e*) a micrometer.

( ) 52. In a machine shop it is customary to have the power circuits wired: (*a*) in series, (*b*) with No. 14 Am. St. wire, (*c*) in parallel, (*d*) by union electricians, (*e*) using the Underwriters' knot.

( ) 53. In production, the work is never inspected with: (*a*) thread gauges, (*b*) taper ring and plug gauges, (*c*) limit gauges, (*d*) caliper gauges, (*e*) reference gauges.

( ) 54. In a machine shop, the wooden members of an article under construction are frequently joined with: (*a*) stud bolts, (*b*) cap screws, (*c*) machine screws, (*d*) carriage bolts, (*e*) tap bolts.

( ) 55. The grade of a grinding wheel depends upon the kind and quantity of: (*a*) grit that is used, (*b*) natural mineral abrasive that is used, (*c*) bond that is used, (*d*) manufactured abrasive that is used, (*e*) wheel shape that is used.

( ) 56. An alloy containing 90 per cent tin, 7 per cent lead and 3 per cent of copper and antimony is called: (*a*) pewter, (*b*) solder, (*c*) babbitt, (*d*) monel, (*e*) bronze.

( ) 57. The American Standard pipe thread is shaped like: (*a*) an Acme thread, (*b*) a 60-degree, sharp-V thread, (*c*) an N.C. series thread, (*d*) an N.F. series thread, (*e*) an A.S.M.E. thread.

( ) 58. A standard machine tool in which the work is mounted on a stationary table, and the cutting bit removes metal with reciprocating strokes, is the: (*a*) planer, (*b*) lathe, (*c*) shaper, (*d*) milling machine, (*e*) surface grinder.

( ) 59. When you use the back gears of a lathe you must: (*a*) engage the clutch, (*b*) use longitudinal hand feed, (*c*) cross feed by hand, (*d*) disengage the bull gear pin, (*e*) engage the bull gear pin.

( ) 60. In welding, it is suggested that if an electrode becomes stuck to the work, one should: (*a*) quickly release the spring jaws of the holder, (*b*) quickly cut it loose with electricians' pliers, (*c*) quickly bend it loose, (*d*) increase the amperage, (*e*) chisel it loose.

( ) 61. Clay, rubber, sodium silicate (water glass), shellac, and bakelite are all used in the manufacture of: (*a*) grinding wheels, (*b*) V belts, (*c*) abrasive cloth, (*d*) abrasive paper, (*e*) lapping compound.

( ) 62. The cutting or squaring of the end of a piece of work mounted between lathe centers is called: (*a*) cylindrical turning, (*b*) squaring, (*c*) feeding, (*d*) facing, (*e*) centering.

( ) 63. The hardness of metal can be accurately tested with inspection equipment named after the metallurgical authorities: (*a*) Ford and Johannson, (*b*) Brown and Sharpe, (*c*) Rockwell and Brinell, (*d*) Starrett and Lufkin, (*e*) Pratt and Whitney.

( ) 64. Special grinding wheels for cutting off lengths of hardened steel are: (*a*) elastic wheels, (*b*) vitrified wheels, (*c*) silicate wheels, (*d*) emery wheels, (e) sandstone wheels.

( ) 65. In machining practice, fillets and rounds are inspected with: (*a*) a radius gauge, (*b*) limit gauges, (*c*) a dial test indicator, (*d*) Johannson gauge blocks, (*e*) a micrometer.

( ) 66. A lathe tool post is securely fastened to the: (*a*) compound rest, (*b*) cross feed, (*c*) apron, (*d*) carriage, (*e*) tailstock.

( ) 67. In machining practice, a mixture of water, soft soap, and sal soda (sodium carbonate or washing soda) is commonly used: (*a*) as a pickling solution, (*b*) to clean dirty castings, (*c*) as a quenching bath, (*d*) as a coolant, (*e*) for bearing lubrication.

( ) 68. Recessed (internal) turning on a machine lathe is accomplished with: (*a*) a knurling tool, (*b*) a straight tool holder, (*c*) a facing tool bit, (*d*) a lathe dog, (*e*) a boring tool.

( ) 69. The carriage must fit the lathe bed with a: (*a*) press fit, (*b*) drive fit, (*c*) sliding fit, (*d*) shrink fit, (*e*) force fit.

( ) 70. A highly decorative metal finish, which is also resistant to weathering and corrosion, is obtained by: (a) shellacking, (*b*) heat treating, (*c*) buffing, (*d*) pickling, (*e*) electroplating.

( ) 71. After being formed, cylindrical sheet-metal shapes, such as stove pipes and furnace pipes, can best be cut with a: (*a*) ring-and-circle shear (*b*) ordinary tin snips, (*c*) double cutting shear, (*d*) bench shear, (*e*) squaring shear.

( ) 72. On an automobile, a replacement starting gear is sometimes fastened to the rim of the flywheel with a: (*a*) shrink fit, (*b*) sliding fit, (*c*) running fit, (*d*) press fit, (*e*) drive fit.

( ) 73. Each individual particle of grit on the face of a grinding wheel removes metal by: (*a*) rubbing, (*b*) burning, (*c*) scraping, (*d*) cutting, (*e*) pressing.

( ) 74. For taking heavy cuts on lathe work of large diameter you should: (*a*) use hand feed, (*b*) oil the cutting bit, (*c*) use a coarse feed, (*d*) use moderate spindle speed, (*e*) use the back gears.

( ) 75. The process of forming sheet metal in the lathe is known as: (*a*) backing, (*b*) spinning, (*c*) turning, (*d*) embossing, (*e*) knurling.

( ) 76. A gear is usually fastened to a keyed shaft with a: (*a*) force fit, (b) running fit, (*c*) drive fit, (*d*) shrink fit, (*e*) press fit.

( ) 77. A standard machine tool in which the work is mounted on a moving table, and a rotating cutter removes metal chips, is the: (*a*) planer, (*b*) milling machine, (*c*) shaper, (*d*) punch press, (*e*) arbor press.

( ) 78. A grinding wheel should be held securely on the shaft by means of: (*a*) a guard, (*b*) a tool rest, (*c*) spring washers, (*d*) safety flanges, (*e*) a lock nut.

( ) 79. A flux commonly used in hard soldering is: (*a*) zinc chloride, (*b*) rosin, (*c*) sal ammoniac, (*d*) borax, (*e*) hydrochloric acid.

( ) 80. A live center is removed from the lathe spindle with a: (*a*) boring bar, (*b*) spanner, (*c*) chuck key, (*d*) box wrench, (*e*) knockout bar.

( ) 81. An irregular bead with much spattering, having a shallow crater with poor penetration, is the result of: (*a*) holding an arc which is too short, (*b*) too much amperage, (*c*) too little amperage, (*d*) holding an arc which is too long, (*e*) using too thick an electrode.

( ) 82. A dead center for a precision lathe should always be: (*a*) made of hardened steel, (*b*) shaped 45-degree conical, (*c*) made of annealed steel, (*d*) adjusted with the cross feed, (*e*) shaped 35-degree conical.

( ) 83. A new grinding wheel is generally furnished with: (*a*) blotting-paper washers, (*b*) glaze, (*c*) a grinding wheel dresser, (*d*) a lock nut, (*e*) a square key.

( ) 84. The hardest metal commonly used in electroplating is: (*a*) nickel, (*b*) copper, (*c*) gold, (*d*) silver, (*e*) chromium.

( ) 85. The heat treatment of edged hand tools, made of carbon steel, usually involves: (*a*) carburizing and hardening, (*b*) annealing and pickling, (*c*) case hardening and tempering, (*d*) hardening and tempering, (*e*) pickling and tempering.

( ) 86. The centers of a machine lathe have a conical angle of: (*a*) 30 degrees, (*b*) 45 degrees, (*c*) 82 degrees, (*d*) 60 degrees, (*e*) 59 degrees.

( ) 87. A square head screw on a lathe dog is adjusted with: (*a*) a Stillson wrench, (*c*) a socket head (Allen) wrench, (*d*) a box wrench, (*e*) an adjustable end wrench.

( ) 88. In the interest of safety, a bench grinder or pedestal grinder should never be operated without: (*a*) a vitrified wheel, (*b*) an elastic wheel, (*c*) a wheel guard, (*d*) a water pot, (*e*) an electric lamp fixture.

( ) 89. The process of hammering art metal work with the smaller end of the hammer head is called: (*a*) chasing, (*b*) repoussé, (*c*) fluting, (*d*) tapping, (*e*) peening.

( ) 90. The process of embossing a cylindrical surface in the lathe with a diamond-shaped pattern, is called: (*a*) finish-turning, (*b*) knurling, (*c*) serrating, (*d*) facing, (*e*) rough-turning.

( ) 91. For turning an irregular object in a lathe chuck, one usually chooses a: (*a*) Jacobs chuck, (*b*) colet chuck, (*c*) 3-jaw universal chuck, (*d*) 4-jaw independent chuck, (*e*) faceplate.

( ) 92. In foundry practice, the patternmaker is usually a workman skilled in: (*a*) sheet-metal drafting and sheet-metal fabrication, (*b*) bench woodwork and machine woodwork, (*c*) toolmaking and diemaking, (*d*) milling machine and machine lathe operation, (*e*) cylindrical grinding and surface grinding.

( ) 93. For straight turning between centers, the lathe has an accessory screwed on the spindle which is called: (*a*) a chuck, (*b*) a dog, (*c*) a tool holder, (*d*) a tool post, (*e*) a faceplate.

( ) 94. The oldest and most important machine in industry is the: (*a*) engine lathe (*b*) electric motor, (*c*) milling machine, (*d*) punch press, (*e*) drill press.

( ) 95. Of the following positions the one that requires the least development of manipulative skill is the: (*a*) turret lathe operator, (*b*) layout man, (*c*) tool dresser, (*d*) personnel engineer, (*e*) coppersmith.

( ) 96. In fitting a shaft to a hole diameter, the difference in their diameters is called the: (*a*) clearance, (*b*) tolerance, (*c*) fit, (*d*) allowance, (*e*) spacing.

( ) 97. The cutting edge of a lathe bit should be adjusted in relation to the work so that it is located: (*a*) 10 degrees above center, (*b*) 10 degrees below center, (*c*) very slightly below center, (*d*) at the height of the center or 5 degrees above, (*e*) never exactly on center.

( ) 98. The feed of a twist drill is defined as: (*a*) the number of r.p.m., (*b*) the distance it advances into the work in one revolution, (*c*) the peripheral speed in ft./sec., (*d*) dependent on the type of shank, (*e*) the peripheral speed in ft./min.

( ) 99. A lathe center drill is a combination of: (*a*) reamer and counterbore, (*b*) twist drill and reamer, (*c*) twist drill and spot facer, (*d*) twist drill and countersink, (*e*) twist drill and counterbore.

( )100. The clamp dog is particularly adapted for turning work that has a: (*a*) rectangular shape, (*b*) spherical shape, (*c*) cylindrical shape, (*d*) round shape, (*e*) tubular shape.

KEY TO TEST

General Metal — Final Term Examination

1. *c*	21. *c*	41. *c*	61. *a*	81. *d*
2. *c*	22. *e*	42. *d*	62. *d*	82. *a*
3. *b*	23. *b*	43. *b*	63. *c*	83. *a*
4. *a*	24. *c*	44. *a*	64. *a*	84. *e*
5. *c*	25. *a*	45. *c*	65. *a*	85. *d*
6. *a*	26. *b*	46. *d*	66. *a*	86. *d*
7. *a*	27. *b*	47. *d*	67. *d*	87. *d*
8. *c*	28. *d*	48. *a*	68. *e*	88. *c*
9. *a*	29. *c*	49. *e*	69. *c*	89. *e*
10. *a*	30. *c*	50. *c*	70. *e*	90. *b*
11. *b*	31. *e*	51. *e*	71. *c*	91. *d*
12. *d*	32. *d*	52. *c*	72. *a*	92. *b*
13. *b*	33. *d*	53. *e*	73. *d*	93. *e*
14. *a*	34. *a*	54. *d*	74. *e*	94. *a*
15. *a*	35. *e*	55. *c*	75. *b*	95. *d*
16. *b*	36. *b*	56. *c*	76. *c*	96. *d*
17. *a*	37. *b*	57. *b*	77. *b*	97. *d*
18. *e*	38. *e*	58. *c*	78. *d*	98. *b*
19. *c*	39. *c*	59. *d*	79. *d*	99. *d*
20. *d*	40. *d*	60. *c*	80. *e*	100. *a*

BEGINNING PRINTING TEST

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Directions: Some of the following statements are true; some false. If the statement is a true one, place a *T* before it. If it is false, place an *F* before it.

( ) 1. There are two common methods for proofing a type form.
( ) 2. It is necessary to thoroughly clean a type form before distribution.
( ) 3. A stone proof is taken on the proof press.
( ) 4. There are five main classifications of type faces and over a thousand related variations.
( ) 5. There are five hundred sheets of paper to the double ream.
( ) 6. There are 33 picas in five and one half inches.
( ) 7. The planer proof method is used for small jobs.
( ) 8. The En quad is sometimes called a nut quad.
( ) 9. Type must rest firmly on its shoulder to give an impression.
( ) 10. Type matter is always read right side up.
( ) 11. Wood type is not found in use today.
( ) 12. Type is held during distribution with the nick upward.
( ) 13. A 3 Em space equals 33 1/3 per cent of the Em quad.
( ) 14. Type is set in the composing stick with the nick up.
( ) 15. Roman numerals are principally used for page designation.
( ) 16. A type form should not be planed if it is tied up.
( ) 17. If a word is to be hyphenated the dictionary should first be consulted.
( ) 18. Twelve points equal two picas.
( ) 19. The lower case "a" is used more than the lower case "e."
( ) 20. There are two basic methods of printing reproduction.
( ) 21. Tweezers are seldom used to pick up type because they may scratch the type face.
( ) 22. In calculating the weight of paper, the ream weight is used.
( ) 23. A ragged paper edge may be called "deckled."
( ) 24. Sixty points equal five and one half picas.
( ) 25. Ten-point body type is larger than twelve-point body type.
( ) 26. There are seventy-two points to six picas, or one inch.
( ) 27. The origin of Text type face classification is of recent date.
( ) 28. A lead may be four points thick.
( ) 29. It is always best to tie up a type form on a flat horizontal surface.
( ) 30. A type form is always placed at the head of the galley.
( ) 31. Printing from an inverted surface is known as intaglio.
( ) 32. The spacing of words in a line of type may vary more than an En quad.
( ) 33. A mixture of gasoline and kerosene is a good cleaning fluid.
( ) 34. Printing from a flat surface is an example of planography.
( ) 35. The stroke of a kerned letter may extend over the type body itself.
( ) 36. Periods separated by spacing material may be used as leaders.
( ) 37. The comma may be used as a quotation mark.
( ) 38. Three Em quads are commonly used to space the words of a line.
( ) 39. To get the desired firmness in justification very few spaces are used.
( ) 40. The dandy roller is inked with colored water.
( ) 41. A lead may be thicker than a slug.
( ) 42. Printing from a raised inked surface is a method known as Relief.
( ) 43. Type is distributed by the words as they are spelled.
( ) 44. The five to the Em space is thicker than the four to the Em space.
( ) 45. The best place to make corrections is when the type is in the galley.
( ) 46. In paper manufacture the *Stuff* travels from the *beater* to the *chipper*.
( ) 47. The type form is always cleaned after a satisfactory print results.
( ) 48. Wood pulp makes up the greater part of newsprint paper.
( ) 49. When the three Em space is too small, the four Em space is used.
( ) 50. In setting short lines the Em quad is usually used to indent.
( ) 51. Ligatures are a combination of specific letters.
( ) 52. The groove on a piece of foundry type is also called the nick.
( ) 53. A lead rule will normally outlast a brass rule.
( ) 54. The usual angle of a mitered corner is forty-five degrees.
( ) 55. The weight of impression may be altered by either underlay or overlay.
( ) 56. A dirty job case should be brushed out.
( ) 57. To rejustify a line of type it should be replaced in the stick.
( ) 58. The nozzle on the cleaning fluid can is operated with the two fingers of the left hand.
( ) 59. The papyrus plant was once used to make paper in Egypt.
( ) 60. Cleaning fluid is applied to a portion of a rag to wipe a form clean.
( ) 61. Piece border is available in many designs which incorporate their own corner designs.
( ) 62. The first job cases in this country came from England.
( ) 63. A rule could be used to border a type form.
( ) 64. Ink dries by absorption and evaporation on the paper.
( ) 65. Furniture may be metal or wood.
( ) 66. A reglet is a thin piece of metal.
( ) 67. A job is planed down when the quoins are fully tight.
( ) 68. The basic size of bond paper is 17 by 22 in.
( ) 69. The nonpareil is just as thick as a slug.
( ) 70. Quoins are placed to the top and right in lock up.
( ) 71. Gothic type face is harder to read than is script.
( ) 72. Gauge pins hold the drawsheet to the platen.
( ) 73. The drawsheet is a soft absorbent paper.
( ) 74. When locking up a job for the press the head of the job should be placed to the top or right of the chase.
( ) 75. Carbon or lamp black pigment is the chief ingredient of black printer's ink.
( ) 76. An Em quad is equal to 100 per cent of the spacing material standard.
( ) 77. The serifs on the lower case *u* and the *n* are the same.
( ) 78. Foundry type may be recognized by a pin mark.
( ) 79. Dead type is not ready for distribution.
( ) 80. A square knot may be used to tie up a type form.
( ) 81. A printed word appears to us in the negative.
( ) 82. An ink roller usually consists of gelatine and glue.
( ) 83. A regular printshop consists of a composing room, press room, and a stock and bindery room.
( ) 84. Early reading material was produced on scrolls.
( ) 85. John Gutenberg developed the first movable type.
( ) 86. A font of type is a certain family style.
( ) 87. The *J* and *U* are the most recently adopted letters of our alphabet.
( ) 88. Spaces are in the center area of the California job case.
( ) 89. Pica length is found stamped on the end of wood furniture.
( ) 90. The adjusting clamp on the composing stick is only removed when various pica widths are desired.
( ) 91. Small spacing material is rarely placed on the end of a line.
( ) 92. Pied type means mixed up type.
( ) 93. The proof mark *w.f.* means to check the spelling.
( ) 94. The line gauge or pica stick is also graduated in inches.
( ) 95. There are several definite styles of quoins which require a key for operation.
( ) 96. A tightly locked form in the chase is never planed.
( ) 97. Ink rollers pass over the type form twice, between each impression, on the platen press.
( ) 98. Some handmade papers are still popular in Japan.
( ) 99. Printers ink mainly consists of color pigment and varnish that have been thoroughly mixed.
( )100. Early composing sticks were made of wood.

KEY TO BEGINNING PRINTING TEST

1. T	21. T	41. F	61. T	81. F
2. T	22. T	42. T	62. T	82. T
3. F	23. T	43. T	63. T	83. T
4. T	24. F	44. F	64. T	84. T
5. F	25. F	45. F	65. T	85. T
6. T	26. T	46. F	66. F	86. T
7. F	27. F	47. T	67. F	87. T
8. T	28. T	48. T	68. T	88. F
9. F	29. F	49. F	69. T	89. T
10. F	30. T	50. T	70. T	90. T
11. F	31. T	51. T	71. F	91. T
12. T	32. F	52. F	72. F	92. T
13. T	33. T	53. F	73. F	93. F
14. T	34. T	54. T	74. T	94. T
15. F	35. T	55. T	75. T	95. T
16. F	36. T	56. F	76. T	96. T
17. T	37. T	57. T	77. F	97. T
18. F	38. F	58. T	78. T	98. T
19. F	39. T	59. T	79. F	99. T
20. F	40. F	60. T	80. F	100. T

MULTIPLE-CHOICE EXERCISE ON FASTENINGS

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Directions: Each of the following statements can be answered correctly by one and only one of the statements which follow it. Underline the statement which you think stands for the correct one. *Do not guess.*

Example: Mechanical drawing is: (*a*) *the language of industry*, (*b*) a foreign language, (*c*) a language that is understood by everyone, (*d*) a language used by mechanical engineers only.

1. A machine structure, usually made up of parts, is held together as a unit by certain devices known as: (*a*) fasteners, (*b*) clips, (*c*) hooks, (*d*) snaps.

2. Fasteners such as bolts, screws, keys, etc., are referred to as: (*a*) permanent fasteners, (*b*) movable fasteners, (*c*) temporary fasteners, (*d*) regular fasteners.

3. Fasteners such as rivets, welds, shrink fits, etc., are referred to as: (*a*) regular fasteners, (*b*) temporary, (*c*) permanent fasteners, (*d*) movable fasteners.

4. A space curve generated around and along the surface of a cylinder by a point moving uniformily in both directions is known as: (*a*) a cycloid, (*b*) an involute, (*c*) a spiral, (*d*) a helix.

5. The helix is the foundation of all: (*a*) spiral curves, (*b*) screw thread curves, (*c*) spring curves, (*d*) gear tooth curves.

6. A smooth helical curve may be drawn by dividing the circle and the pitch into: (*a*) 8 equal parts, (*b*) 12 equal parts, (*c*) 16 equal parts, (*d*) as many equal parts as are necessary.

7. The development of a screw thread or helix is in the form of: (*a*) a scalene triangle, (*b*) an isosceles triangle, (*c*) right triangle, (*d*) equilateral triangle.

8. The long base of the triangle mentioned in statement 7 is equal to the: (*a*) circumference of the screw, (*b*) pitch of the screw, (*c*) diameter of the screw, (*d*) length of the screw.

9. The height of the triangle mentioned in statement 7 is equal to the: (*a*) circumference of the screw, (*b*) lead of the screw, (*c*) pitch of the screw, (*d*) length of the screw.

10. The hypotenuse of the triangle mentioned in statement 7 represents the exact curve of the screw thread commonly known as the: (*a*) lead, (*b*) pitch, (*c*) circumference, (*d*) helix.

11. In drawing a single threaded screw, it is important that the crest points are: (*a*) opposite the root points, (*b*) in line with the root points, (*c*) perpendicular with the root points, (*d*) at angle of 90 degrees with the root points.

12. When a thread is cut on the outer surface of a fastener, it is an: (*a*) eternal thread, (*b*) external thread, (*c*) internal thread, (*d*) infernal thread.

13. The outside diameter of a screw thread is usually referred to as the: (*a*) effective diameter, (*b*) minor diameter, (*c*) pitch diameter, (*d*) major diameter.

14. The root diameter of a screw is generally referred to as the: (*a*) minor diameter, (*b*) pitch diameter, (*c*) major diameter, (*d*) outside diameter.

15. The distance from the crest of one thread to the corresponding crest of the adjacent thread measured parallel to the axis of the threaded piece is equal to the: (*a*) lead, (*b*) pitch, (*c*) diameter, (*d*) length.

16. The rule for finding the pitch of a screw thread is one divided by the: (*a*) lead of the thread, (*b*) diameter of the thread, (*c*) number of threads per inch, (*d*) length of the thread.

17. When the screw thread is formed on the inner surface of a fastener, it is referred to as an: (*a*) internal thread, (*b*) infernal thread, (*c*) external thread, (*d*) eternal thread.

18. The distance a screw thread advances parallel to the axis in one complete turn is called the: (*a*) pitch, (*b*) lead, (*c*) leader, (*d*) circumference.

19. Whenever the lead equals the pitch, the thread is said to be a: (*a*) double thread, (*b*) triple thread, (*c*) single thread, (*d*) simple thread.

20. When the pitch is equal to one half the lead, it is said to be a: (*a*) simple thread, (*b*) single thread, (*c*) triple thread, (*d*) double thread.

21. The top surface which joins the two sides of a thread is called the: (*a*) root of the thread, (*b*) base of the thread, (*c*) crest of the thread, (*d*) pitch of the thread.

22. The bottom surface which joins the sides of two adjacent threads is referred to as the: (*a*) crest of the thread, (*b*) root of the thread, (*c*) pitch of the thread, (*d*) thread angle.

23. The surface connecting the crest and root of a thread is the: (*a*) side of the thread, (*b*) thread angle, (*c*) back of the thread, (*d*) outside of the thread.

24. The distance between the crest and the root of the thread measured at right angles to the axis is called the: (*a*) width of the thread, (*b*) outside of the thread (*c*) depth of the thread, (*d*) pitch of the thread.

25. A screw thread whose crest and root are not flattened and whose thread angle is 60 degrees is known as the: (*a*) American Standard thread, (*b*) Sharp-V thread, (*c*) English Standard thread, (*d*) Buttress thread.

26. The Sharp-V thread is used on high precision instruments and also to increase the holding power of: (*a*) setscrews, (*b*) machine screws, (*c*) cap screws, (*d*) leg screws.

27. A modified V thread, with crests and roots flattened, has been approved and standardized by the American Standard Association, and is called the: (*a*) Sharp-V thread, (*b*) British Standard thread, (*c*) Knuckle thread, (*d*) American Standard thread.

28. Our national screw thread system, having like thread form but differing in relation to pitch and diameter, comprises of: (*a*) six thread series, (*b*) five thread series, (*c*) four thread series, (*d*) three thread series.

29. The British Standard thread used mostly in Great Britain and roughly resembling the American Standard is known as the: (*a*) Whitworth Standard thread, (*b*) Acme thread, (*c*) Square thread, (*d*) B. & S. Worm thread.

30. The thread angle of the American Standard thread is 60 degrees while that of the British Standard is: (*a*) 29 degrees, (*b*) 45 degrees, (*c*) 90 degrees, (*d*) 55 degrees.

31. The crests and roots of the American Standard thread are flattened: (*a*) ½ of the pitch, (*b*) ¼ of the pitch, (*c*) ⅛ of the pitch, (*d*) 1/16 of the pitch.

32. An ideal thread to use for transmitting power of motion parallel to the axis is the: (*a*) Square thread, (*b*) Sharp-V thread, (*c*) Whitworth thread, (*d*) American Standard thread.

33. A modification of the Square thread and one which is much stronger and easier to cut is the: (*a*) Buttress thread, (*b*) Knuckle thread, (*c*) Dardelet thread, (*d*) Acme thread.

34. A thread having the advantage of the square thread, the shearing strength of the V thread and used to transmit power in one direction only is the: (*a*) Square thread, (*b*) Acme thread, (*c*) Buttress thread, (*d*) American Standard thread.

35. The depth of the Square thread and the Acme thread is equal to: (*a*) ¼ of the pitch, (*b*) ½ of the pitch, (*c*) ¾ of the pitch, (*d*) the pitch.

36. The crests and roots of the Buttress thread are flattened: (*a*) ½ of the pitch, (*b*) ⅜ of the pitch, (*c*) ¼ of the pitch, (*d*) ⅛ of the pitch.

37. A thread that advances into a nut or into a tapped hole when turned in a clockwise direction is a: (*a*) back-hand thread, (*b*) left-hand thread, (*c*) right-hand thread, (*d*) fore-hand thread.

38. The angle of the Buttress thread is: (*a*) 30 degrees, (*b*) 45 degrees, (*c*) 60 degrees, (*d*) 75 degrees.

39. The angle of the Acme thread is: (*a*) 29 degrees, (*b*) 39 degrees, (*c*) 49 degrees, (*d*) 50 degrees.

40. The semiconventional method of thread representation is used: (*a*) only on thread diameters of 1 in. or less, (*b*) only on thread diameters of 1 in. or more, (*c*) on all sizes of thread diameters, (*d*) only on threads shown in isometric drawings.

41. Before a draftsman can draw a thread, he must have information on: (*a*) three items concerning the thread, (*b*) four items concerning the thread, (*c*) five items concerning the thread, (*d*) six items concerning the thread.

42. The head of a fillister head cap screw will require a hole that is: (*a*) drilled, (*b*) bored, (*c*) countersunk, (*d*) counterbored.

43. The screw thread recommended for general use is the: (*a*) National fine thread, (*b*) National coarse thread, (*c*) National 8-pitch thread, (*d*) National 12-pitch thread.

44. For general use in machine work, the American Standard Association has standardized: (*a*) 2 classes of screw thread fits between bolts and nuts, (*b*) 3 classes of screw thread fits between bolts and nuts, (*c*) 4 classes of screw thread fits between bolts and nuts, (*d*) 5 classes of screw thread fits between bolts and nuts.

45. Where it is necessary to have clearance between a screw thread and its mating part for rapid assembly, a class: (*a*) 4 fit is used, (*b*) 3 fit is used, (*c*) 2 fit is used, (*d*) 1 fit is used.

46. A thread that advances into a nut or into a tapped hole when it is turned in a counterclockwise direction is a: (*a*) left-hand thread, (*b*) right-hand thread, (*c*) back-hand thread, (*d*) fore-hand thread.

47. For thread 1 in. or less in diameter, the American Standard Association has provided: (*a*) four forms of conventional thread representation symbols, (*b*) three forms of conventional thread representation symbols, (*c*) two forms of conventional thread representation symbols, (*d*) no forms of thread representation symbols.

48. The thread symbol which does not describe the V profile of the thread but which indicates the crests with a fine line and the roots with a heavy line both perpendicular to the axis is called the: (*a*) simplified form, (*b*) semiconventional form, (*c*) irregular form, (*d*) regular form.

49. The thread symbol which omits both the V profile and the cross lines of the crests and the roots but which indicates the threaded portion by dotted lines drawn parallel to the axis at approximately the depth of the thread is referred to as the: (*a*) simplified form, (*b*) regular form, (*c*) irregular form, (*d*) semiconventional form.

50. Cutting threads on the inner surface of a hole is called: (*a*) drilling, (*b*) tapping, (*c*) reaming, (*d*) boring.

51. Before a hole is tapped, it must be drilled to a certain diameter with a: (*a*) countersink, (*b*) star drill, (*c*) tap, (*d*) tap drill.

52. The end view of a tapped hole is illustrated on a drawing with: (*a*) a full circle and a dotted circle, (*b*) two full circles, (*c*) two dotted circles, (*d*) no circles.

53. The large circle used in the end view of a tapped hole is equal to the: (*a*) minor diameter of the threads, (*b*) major diameter of the threads, (*c*) effective diameter of the threads, (*d*) pitch diameter of the threads.

54. The large circle used in the end view of a tapped hole is drawn as a: (*a*) light full circle, (*b*) heavy full circle, (*c*) dotted circle, (*d*) center circle.

55. The small circle used in the end view of a tapped hole is equal to the: (*a*) minor diameter of the thread, (*b*) outside diameter of the thread, (*c*) major diameter of the thread, (*d*) pitch diameter of the thread.

56. The small circle used in the end view of a tapped hole is drawn as a: (*a*) center circle, (*b*) full circle, (*c*) light dotted circle, (*d*) heavy dotted circle.

57. The letters N.F. are used in a thread specification on a drawing to indicate that a: (*a*) National full thread is required, (*b*) National fair thread is required, (*c*) National fine thread is required, (*d*) National fitted thread is required.

58. The numeral preceding the letters N.C. or N.F. specifies the: (*a*) number of the fit that the thread is to have, (*b*) diameter of the thread of the bolt, (*c*) length of the bolt in inches, (*d*) number of threads per inch.

59. The slotted cylindrical head of a cap screw is known as a: (*a*) flat head, (*b*) fillister head, (*c*) round head, (*d*) oval head.

60. A round metal bar enlarged at one end to form a head and threaded at the other end fitted with a nut is called a: (*a*) stud, (*b*) tap bolt, (*c*) through bolt, (*d*) lag bolt.

61. The head and nut of a rough or unfinished through bolt are usually made: (*a*) hexagonal, (*b*) square, (*c*) round, (*d*) flat.

62. The head of a flat head cap screw will require a hole that is: (*a*) drilled, (*b*) reamed, (*c*) counterbored, (*d*) countersunk.

63. The distance measured from the underside of the head to the end of the bolt is known as the: (*a*) size of the bolt, (*b*) diameter of the bolt, (*c*) length of the bolt, (*d*) over-all length of the bolt.

64. The threaded end of the bolt is: (a) semicircular and chamfered, (*b*) flat and chamfered, (*c*) hollowed and chamfered, (*d*) oval and chamfered.

65. The chamfered end of the bolt is made to the depth of the thread and at an angle of: (*a*) 15 degrees with the flat surface, (*b*) 30 degrees with the flat surface, (*c*) 45 degrees with the flat surface, (*d*) 60 degrees with the flat surface.

66. The thickness of the washer face on a bolthead is usually: (*a*) ⅛ in., (*b*) 1.16 in., (*c*) 1/64 in., (*d*) 1/32 in.

67. The diameter of the washer face on a bolthead is equal to the: (*a*) diameter of the bolt, (*b*) distance across the flats, (*c*) thickness of the head of the bolt, (*d*) thickness of the nut.

68. A bolt that passes through a hole in one piece and is screwed into a tapped hole in the other piece is a: (*a*) tap bolt, (*b*) stud bolt, (*c*) stove bolt, (*d*) carriage bolt.

69. The crests and roots of the Whitworth Standard thread are rounded: (*a*) ½ of the depth of the triangle, (*b*) ⅛ of the depth of the triangle, (*c*) 1/3 of the depth of the triangle, (*d*) 1/6 of the depth of the triangle.

70. The semiconventional method consists in drawing the exact shape of the thread profile and connecting the roots and crests with a: (*a*) broken straight line, (*b*) full straight line, (*c*) helical curved line, (*d*) circular curved line.

71. The series having a greater number of threads per inch, used mostly in automobile work, is called the: (*a*) National fine series, (*b*) National fitted series, (*c*) National form series, (*d*) National full series.

72. A complete specification on a drawing for a thread that is ⅞ in. in diameter having 9 threads per inch of the coarse series and a class 2 fit is shown in the following manner: (*a*) ⅞ in. 9 N.C. tapped, (*b*) ⅞ in. N.C. — 2, (*c*) ⅞ in. 9 N.C., (*d*) ⅞ in. 9 N.C. — 2.

73. A note lettered on the drawing giving the diameter of the tap drill and the depth of the drilled hole followed by the thread specification and the length of the thread is needed by the mechanic for making a: (*a*) drilled hole, (*b*) reamed hole, (*c*) tapped hole, (*d*) bored hole.

74. The length of the thread on a regular bolt usually is equal to: (*a*) 1½ times the diameter plus ¼ inch, (*b*) 1½ times the diameter, (*c*) diameter plus ¼ inch, (*d*) diameter.

75. A circular steel rod threaded at both ends is commonly called a: (*a*) carriage bolt, (*b*) through bolt, (*c*) tap bolt, (*d*) stud.

76. The American Standard bolt is made in two series, the: (*a*) regular and the irregular series, (*b*) regular and the light series, (*c*) regular and the heavy series, (*d*) medium and the heavy series.

77. The American Standard Association has adopted: (*a*) two classes of finish for both series of bolts, (*b*) three classes of finish for both series of bolts, (*c*) four classes of finish for both series of bolts, (*d*) five classes of finish for both series of bolts.

78. The finished bolthead in both series is produced only in the: (*a*) square form, (*b*) round form, (*c*) octagonal form, (*d*) hexagonal form.

79. The top surface of the bolthead in both series, regardless of finish, is made: (*a*) flat, (*b*) chamfered, (*c*) flat and chamfered, (*d*) round and chamfered.

80. A tap bolt that has been machined all over is classed as a: (*a*) rough bolt, (*b*) finished bolt, (*c*) semifinished bolt, (*d*) threaded bolt.

81. The thickness of a hexagonal nut for a regular finished bolt is: (*a*) ⅞ times the diameter of the bolt, (*b*) ¾ times the diameter of the bolt, (*c*) 2/3 times the diameter of the bolt, (*d*) equal to the diameter of the bolt.

82. The rule for finding the distance across the flats of a heavy series hexagonal head or nut is: (*a*) 1½ times the diameter of the bolt, (*b*) 1½ times the diameter of the bolt plus ⅛ in., (*c*) 1½ times the diameter of the bolt plus 1/16 in., (*d*) 1½ times the diameter of the bolt plus ¼ in.

83. If any surface of a bolthead and nut is not machined except for the threads, the bolt is classed as a: (*a*) finished bolt, (*b*) semifinished bolt, (*c*) rough bolt, (*d*) stud bolt.

84. When a finished appearance and close dimensions are required as on a jig or fixture, the various parts are fastened with: (a) lag

screws, (*b*) setscrews, (*c*) machine screws, (*d*) cap screws.

85. Cap screws in both series of threads have a class: (*a*) 1 fit, (*b*) 2 fit, (*c*) 3 fit, (*d*) 4 fit.

86. Ordinarily the regular series of boltheads and nuts meet the requirements as fasteners for: (*a*) airplane work, (*b*) high grade work, (*c*) general use, (*d*) precision work.

87. The diameter of the circle representing the flat top surface of a bolthead is equal to: (*a*) the height of the head, (*b*) the thickness of the nut, (*c*) one half the distance across the flats, (*d*) the distance across the flats.

88. When a greater bearing surface is essential in fastening two machine parts, the: (*a*) heavy series bolthead and nut is used, (*b*) medium series bolthead and nut is used, (*c*) light series bolthead and nut is used, (*d*) regular bolthead and nut is used.

89. A bolthead and nut machined to provide a smooth bearing surface either plain or washer faced is classed as: (*a*) smooth, (*b*) rough, (*c*) semifinished, (*d*) finished.

90. The American Standard Association has standardized: (*a*) 3 forms of heads for cap screws, (*b*) 4 forms of heads for cap screws, (*c*) 5 forms of heads for cap screws, (*d*) 6 forms of heads for cap screws.

91. A screw fastener similar in appearance but smaller than a cap screw and used primarily on jigs and fixtures is a: (*a*) machine screw, (*b*) hook screw, (*c*) setscrew, (*d*) wood screw.

92. All standard machine screws are made in: (*a*) rough form only, (*b*) finished form only, (*c*) semifinished form only, (*d*) copper only.

93. The American Standard Association has standardized: (*a*) 2 forms of heads for machine screws, (*b*) 3 forms of heads for machine screws, (*c*) 4 forms of heads for machine screws, (*d*) 5 forms of heads for machine screws.

94. All machine screws are made with a: (*a*) screw driver slot, (*b*) square head, (*c*) hexagon head, (*d*) round head.

95. A screw made of hardened steel for holding two machine parts in relative position to prevent them from turning or slipping is a: (*a*) cap screw, (*b*) setscrew, (*c*) machine screw, (*d*) tap screw.

96. A piece of steel used as a fastener to lock a wheel to a shaft and cause the wheel to turn with the shaft is called a: (*a*) cog, (*b*) latch, (*c*) key, (*d*) keyway.

97. The semicircular key made to fit into a semicircular groove cut in a shaft so that the key can adjust itself to the taper in the keyway in the hub is known as: (*a*) Woodruff key, (*b*) gib nose key, (*c*) flat key, (*d*) feather key.

98. The formula for finding the height of an unfinished regular hexagonal bolthead is: (*a*) $\frac{3D}{4}$, (*b*) $\frac{2D}{3}$, (*c*) $\frac{7D}{8}$, (*d*) $\frac{3D}{4}$ plus 1/16 in.

99. Setscrews used to comply with laws prohibiting the use of projecting screws on moving parts are called: (*a*) square head setscrews, (*b*) fillister head setscrews, (*c*) headless setscrews, (*d*) round head setscrews.

100. The distance across the flats of a head for a semifinished regular hexagonal bolt is: (*a*) diameter of the bolt, (*b*) ¾ times the diameter of the bolt, (*c*) ⅞ times the diameter of the bolt, (*d*) 1½ times the diameter of the bolt.

ANSWERS

1. *a*	21. *c*	41. *c*	61. *b*	81. *a*
2. *b*	22. *b*	42. *d*	62. *d*	82. *b*
3. *c*	23. *a*	43. *b*	63. *c*	83. *c*
4. *d*	24. *c*	44. *c*	64. *b*	84. *d*
5. *b*	25. *b*	45. *d*	65. *b*	85. *b*
6. *d*	26. *a*	46. *a*	66. *c*	86. *c*
7. *c*	27. *d*	47. *c*	67. *b*	87. *c*
8. *a*	28. *b*	48. *d*	68. *a*	88. *a*
9. *c*	29. *a*	49. *a*	69. *d*	89. *c*
10. *d*	30. *d*	50. *b*	70. *b*	90. *d*
11. *a*	31. *c*	51. *d*	71. *a*	91. *a*
12. *b*	32. *a*	52. *a*	72. *d*	92. *b*
13. *d*	33. *d*	53. *b*	73. *c*	93. *c*
14. *a*	34. *c*	54. *c*	74. *a*	94. *a*
15. *b*	35. *b*	55. *a*	75. *d*	95. *b*
16. *c*	36. *d*	56. *b*	76. *c*	96. *c*
17. *a*	37. *c*	57. *c*	77. *b*	97. *a*
18. *b*	38. *b*	58. *d*	78. *d*	98. *b*
19. *c*	39. *a*	59. *b*	79. *c*	99. *c*
20. *d*	40. *b*	60. *c*	80. *b*	100. *d*

SHOP INSTRUCTOR'S SAFETY QUIZ

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How to score this quiz: *Yes* being the proper answer:

1 wrong: You and your shop are to be congratulated.
2–3 wrong: There's room for improvement of your safety habits.
4–5 wrong: Let's take a look at your safety record. If it doesn't look too bad you have been lucky so far but how long will your luck hold out?

1. Do all of your students receive adequate instruction in safe use of all machines before being permitted to operate these machines? Yes.. No..

2. Are all machine tools properly guarded and all guards kept in position while machines are in operation? Yes.. No..

3. Are all machines properly maintained and checked for proper adjustment periodically? Yes.. No..

4. Do all machines have safety zones painted around them and are these safety zones observed at all time by the instructor as well as by the students? Yes.. No..

5. Is the first aid kit available and ready for instant use? Yes.. No..

6. Does your shop have a fire blanket near any open flame? Yes.. No..

7. Do you make constant effort to maintain proper ventilation in your shop? Yes.. No..

8. Are materials such as lumber and metal kept neatly stacked, away from heavily traveled areas? Yes.. No..

9. Are the floors, aisles, and benches cleared of waste and scrap after each class? Yes.. No..

10. Do you have a sufficient number of fire extinguishers for your shop and are they properly charged and inspected? Yes.. No..

11. Do you instruct certain of your students in the proper use of fire extinguishers? Yes.. No..

12. Are your machines properly fused and electrical connections cleaned and inspected at least twice each year? Yes.. No..

13. Are oily waste and dirty rags kept in metal containers and emptied before you leave the shop? Yes.. No..

14. Do pointed and heavy tools have proper holders in tool cabinets so that there is little possibility of their falling and causing injuries to students? Yes.. No..

AIRCRAFT STRUCTURES TEST

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General directions: Read each question carefully and answer as directed at the beginning of each part. This is not a test to see how fast you can work; it is a test to see how much you know. If you do not know the answer to a question, do not spend too much time on it; proceed to the next questions and then to the next part. No questions will be answered after the examination begins. Are there any questions now? If not, begin.

Part I

Directions: Some of the following statements are true, and some are false. In each case write *T* on the left of the statement if you think it is true, or write *F* on the left if you think the statement is false.

( ) 1. An airplane with one set of wings is known as a biplane.
( ) 2. Welded chrome-molybdenum steel tubing is well adapted for construction of engine mounts.
( ) 3. Flush type Dzus fasteners are commonly used for attaching cowling.
( ) 4. Engine mounts permit engine vibration to be transmitted to the airplane structure.
( ) 5. Cantilever wings are usually so constructed that the skin is part of the wing structure, carrying part of the wing stresses.
( ) 6. Stringers circle the airplane and act as support for the skin.
( ) 7. Duraluminum, or dural, is a strong, light alloy of aluminum, copper, and manganese.
( ) 8. Fairing is placed between external structural parts for the purpose of streamlining and improving the appearance of an airplane.
( ) 9. A gusset is a small, generally triangular shape, brace used to strengthen corners in a structure.
( ) 10. The foremost edge of an airplane wing or propeller blade is called the trailing edge.
( ) 11. Tail wheels are designed to swivel

and in many cases they are controllable with the rudder through its range of movement.

( ) 12. An insulator should be used between two dissimilar metals when they are being riveted together.

( ) 13. 17S rivets are identified by having two dashes on the rivet heads.

( ) 14. The radius of which a piece of metal may be bent depends on the thickness of the metal.

( ) 15. Small holes on a skin-stressed fuselage cannot be repaired.

Part II

Directions: The following are sentences with missing words or phrases. Fill in the blanks with the correct words or phrases necessary to complete each sentence.

1. The principal structural units of an airplane are ....., ..., ..., ..., ..., ..., and .....

2. Control surfaces consists of ....., ..., ..., ..., and .....

3. The vertical stabilizer is for the purpose of .....

4. The horizontal stabilizer is for the purpose of .....

5. The ..... consists of horizontal stabilizer, vertical stabilizer, rudder, elevators, rudder tab, and elevator tabs.

6. Aluminum alloy covered with a thin coat of pure aluminum is known by the trade name of .....

8. Stresses affecting airplane structure are ....., ..., ..., ..., and .....

9. The top and bottom members of an "I" beam are called .....

10. Solid, circular reinforcing members that support the skin of an airplane and divide the fuselage into compartments are called .....

11. ..... is used as a protective coating on aluminum alloys.

12. Countersunk head rivets are used mainly for .....

Part III

Column 1

Directions: The meaning or association of words in column 1 are to be found in column 2. In the space to the left of each number write the letter from column 2, which explains the meaning or association of that particular word.

.... 1. longeron
.... 2. primary structure
.... 3. spar
.... 4. leading edge
.... 5. rib
.... 6. split flap
.... 7. nacelle
.... 8. tab
.... 9. tip
.... 10. strut

Column 2

a) the main framework of an airplane
b) foremost edge of an airfoil
c) compression member of a truss frame
d) principal longitudinal member of the framing of an airplane fuselage or nacelle
e) main structural supporting member of an airplane wing
f) a cord-wise member of the wing structure
g) outer end of an airplane wing
h) hinged plate forming the rear upper or lower portion of an airfoil
i) enclosed section which contains the power plant
j) duct carrying exhaust gases
k) auxiliary airfoil attached to a control surface
l) the distance between wings of a biplane

Part IV

Directions: Each incomplete sentence is followed by a group of words or phrases. Underline the correct words or phrases following each sentence which will complete that sentence.

1. Aluminum alloys are used in airplane construction because they are as strong as mild steel and because the weight is: (*a*) one half that of steel; (*b*) one third that of steel; (*c*) one fourth that of steel; (*d*) one fifth that of steel.

2. In order to lessen fire risk, nacelle firewalls are built of: (*a*) aluminum; (*b*) aluminum alloy; (*c*) corrugated iron; (*d*) stainless steel.

3. A material commonly used for small fittings, such as pulleys, fairleads, quadrants, etc., is: (*a*) magnesium; (*b*) aluminum; (*c*) plastics; (*d*) fabric.

4. The strip of metal used to round out the angles where two sections join, such as wing to fuselage, is called: (*a*) fairing; (*b*) bevel; (*c*) forging; (*d*) casting.

5. Holes are punched in ribs, spars, and other members for: (*a*) access to hydraulic tubing and electrical wires only; (*b*) reducing weight and providing passage ways for cables, tubes, wires, etc.; (*c*) reducing weight only; (*d*) providing heat circulation passage for deicing wings.

6. Dowmetal M is: (*a*) a nickel-copper alloy; (*b*) an aluminum alloy of high tensile strength; (*c*) a magnesium alloy; (*d*) a heat-resistant steel.

7. Hardness of a metal is tested by: (a) a Rockwell tester; (*b*) bending; (*c*) heating; (*d*) hitting with a hammer.

8. Inconel (a registered trade-mark of the International Nickel Company) is a: (*a*) magnesium alloy; (*b*) casehardened steel; (*c*) nickel-copper alloy; (*d*) nickel-chromium-iron alloy.

9. If a crack occurs near a mounting lug on an engine mount ring: (*a*) it may be repaired; (*b*) it may not be repaired; (*c*) the mount must be returned to the manufacturer; (*d*) a new section must be put in the mount.

10. Aluminum alloy sheet-metal parts which are to be left uncoated should be made from: (*a*) 24S-T; (*b*) 75S-T; (*c*) Alclad; (*d*) Dowmetal M.

11. Copper fuel and oil lines are annealed at the following temperature: (*a*) 800 degrees F.; (*b*) 1000 degrees F.; (*c*) 1325 degrees F.; (*d*) 1550 degrees F.

12. Parker Kalon is a: (*a*) special wood and metal screw; (*b*) special machine screw; (*c*) special screw for attaching metal to plastic; (*d*) self-tapping sheet-metal screw.

13. Brazier head rivets are used for: (*a*) fuselage skinning; (*b*) flush riveting; (*c*) internal bulkheads; (*d*) longerons.

14. 17S-T and 24S-T, before being assembled, should be: (*a*) painted; (*b*) lacquered; (*c*) annealed; (*d*) anodized and primed.

15. Proper edge distance for rivets is: (*a*) shank diameter; (*b*) twice shank diameter; (*c*) three times shank diameter; (*d*) four times shank diameter.

KEY AND SUGGESTED SCORING

Part I (one point each)

1. F	4. F	7. T	10. F	13. F
2. T	5. T	8. T	11. T	14. T
3. T	6. F	9. T	12. T	15. F

Part II (two points each blank)

1. fuselage, nacelle, wings, empennage, control surfaces, engine mount, and landing gear
2. elevators, rudder, tabs, flaps, and ailerons
3. preventing sudden yawing to right or left
4. helping to maintain level flight
5. empennage
6. Alclad
7. wood
8. tension, compression, shearing, torsion, and bending
9. flanges
10. bulkheads
11. Zinc chromate
12. flush riveting

Part III (two points each)

1. *d*	3. *e*	5. *f*	7. *i*	9. *g*
2. *a*	4. *b*	6. *h*	8. *k*	10. *c*

Part IV (one point each)

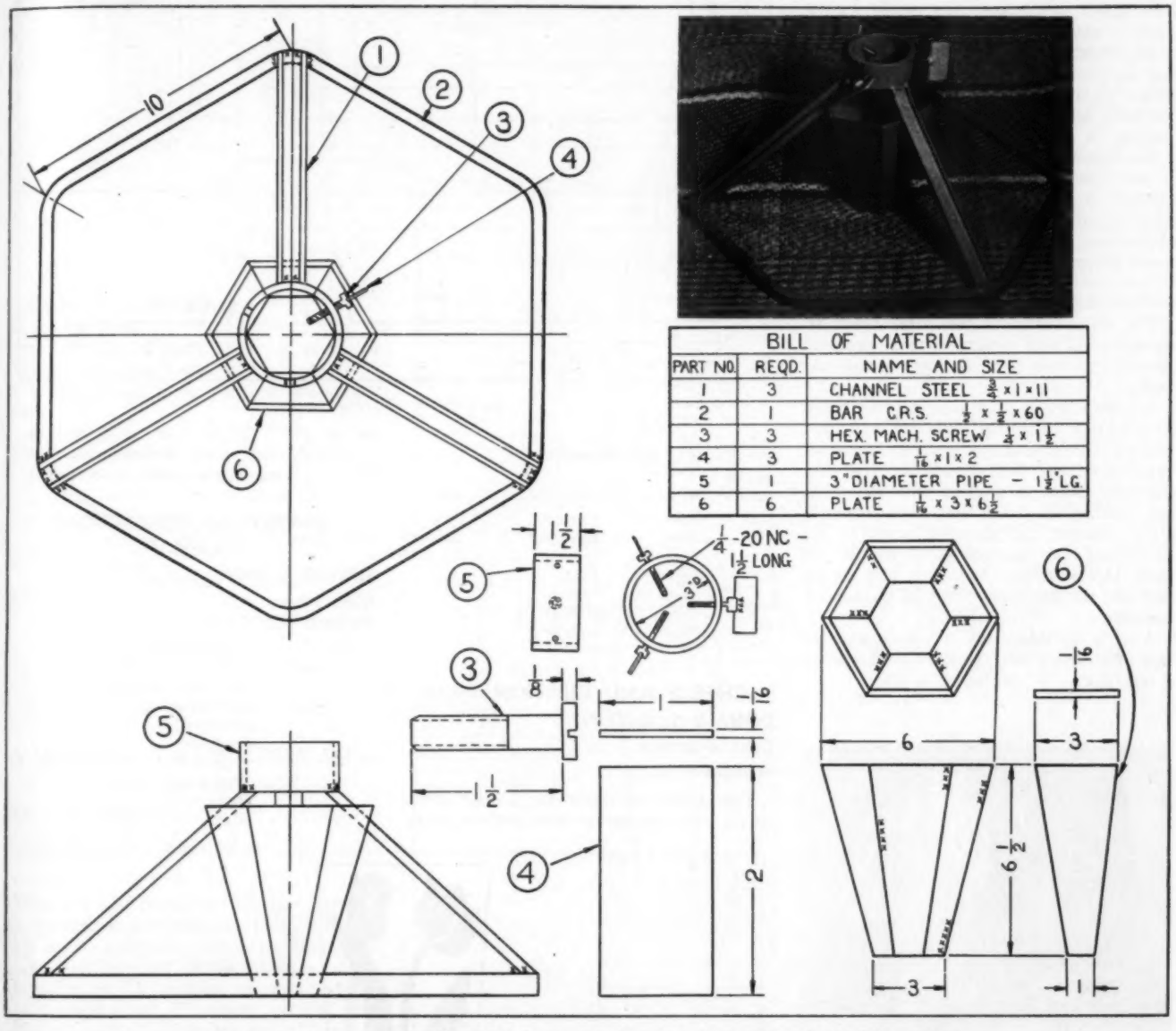
1. *b*	4. *a*	7. *a*	10. *c*	13. *a*
2. *d*	5. *b*	8. *d*	11. *b*	14. *d*
3. *c*	6. *c*	9. *a*	12. *d*	15. *b*

Much of the strength of a school shop safety program depends on how unconsciously the boy or girl learns to act safely. The effectiveness of specific safety instruction in a concentrated dose becomes dulled when interest in a new topic pushes "safety" into the background. An objective then of a school shop safety program or for that matter of a safety program in any other situation is to teach the youngster to regard the safety aspects of his every activity. His method of performance in each thing he learns to do is not satisfactory unless the method is safe as well as effective. — *School Shop Safety Newsletter.*

Australia's World War II memorial to the United States, to be constructed in 1951, will consist of a single, 250-foot shaft of aluminum topped with a bronze eagle.

Aluminum foil wrapped around wet paint brushes will keep the bristles pliable for several days.

PROBLEMS AND PROJECTS



BILL OF MATERIAL		
PART NO.	REQD.	NAME AND SIZE
1	3	CHANNEL STEEL $\frac{3}{4} \times 1 \times 11$
2	1	BAR C.R.S. $\frac{1}{2} \times \frac{1}{2} \times 60$
3	3	HEX. MACH. SCREW $\frac{1}{4} \times 1\frac{1}{2}$
4	3	PLATE $\frac{1}{16} \times 1 \times 2$
5	1	3" DIAMETER PIPE – $1\frac{1}{2}$" LG.
6	6	PLATE $\frac{1}{16} \times 3 \times 6\frac{1}{2}$

Christmas tree stand submitted by Louis Barocci, High School, Cudahy, Wis.

PLANTER LAMP

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When we think of the usages of concrete we are likely to visualize a substance that is usually employed in the construction of massive projects such as building foundations, bridges, and highways. Unfortunately, one seldom associates concrete with projects carried on in an industrial-arts shop and yet there are many useful and artistic objects which can be made by pupils at almost any grade level, beginning with that of the junior high school. Activity in concrete can become a practical, enjoyable hobby involving a minimum outlay for tools and supplies.

An example of such a project is the planter lamp. This project includes the following:

1. Making a wooden form to the desired size and design.
2. Mixing and pouring concrete.
3. Making tubular metal lamp support.
4. Wiring for electricity.

In the steps outlined, five separate activities are combined: woodworking, plumbing, metalworking, electrical wiring, and mixing concrete.

The form into which the concrete is poured can be made to suit the desires of the individual as to size, weight, design, etc. The easiest form to make would be one with perpendicular sides and no design. The more complicated the design, the more skill is required, and this degree of skill should be considered in terms of the grade level of the pupils.

To determine the correct amount of cement to be used, the form is filled with sand. The sand is then removed so that the amount used may be measured. A quantity of cement equal to 1/3 the amount of sand used is then mixed thoroughly with the sand. Water is then added slowly until the proper consistency is obtained. Place a ⅛-inch pipe nut in the center of the base and pour the mixture into the form, packing down firmly in order to relieve all air pockets. Coat the interior of the form with machine or linseed oil before pouring.

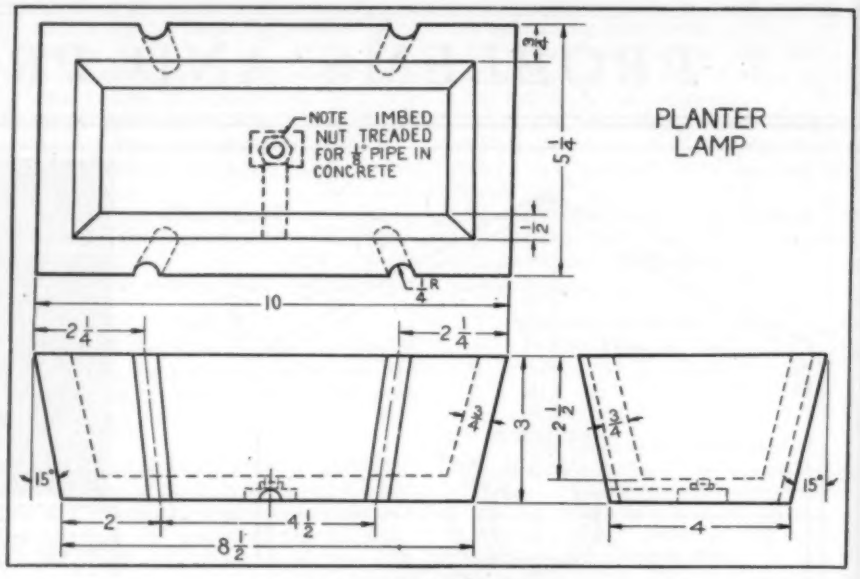
The cement should be allowed to set for at least one day before the form is removed. Cement and water mixed to a pastelike consistency is then applied to all outside surfaces of the base. When thoroughly dry this application leaves a smooth, satinlike finish. Shellac is then applied and when dry the exterior of the base may be painted the desired color.

The inside walls of the base should be waterproofed with roofing pitch in order to prevent moisture from seeping through the walls.

A 13-in. piece of ⅛-in. pipe is now screwed into the pipe nut in the base, and is covered with a 12-in. piece of 1-in. diameter brass pipe which has been buffed and lacquered. An electrical socket is screwed onto the ⅛-in. pipe holding the brass lamp stem firmly in place. Connect the electrical wires to the socket and run the cord down through the ⅛-in. pipe and base. Wire wall plug to the cord and the electrical portion of the lamp is complete.

After a suitable shade is put on and the base filled with plants, the job is complete and a very attractive lamp is the result.

Planter lamp



Details of planter lamp

BILL OF MATERIAL

No. of pieces	*Name*	*Material*	*Size*
1	Base	Concrete	3 x 5¼
1	Stem	Brass pipe	1 dia. x 12
1	Pipe	Iron	⅛ dia. x 13
1	Socket	Brass	
1	Shade harp	Brass	
1	Cord	Rubber	10 ft. long
1	Plug	Rubber	

CHEESE AND CRACKER DISH

DONALD S. GUERIN
Central School
Willsboro, N. Y.

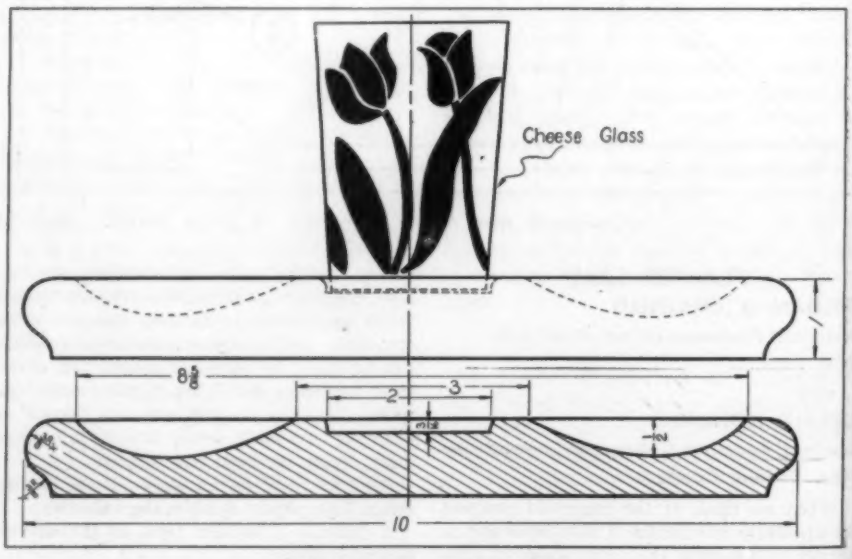
This cracker and cheese dish is easily turned on the lathe, preferably from birch or maple. A natural finish with a French polish is suggested to bring out the beauty of the wood.

SPARKPLUG (CHAMPION) MOCK-UP

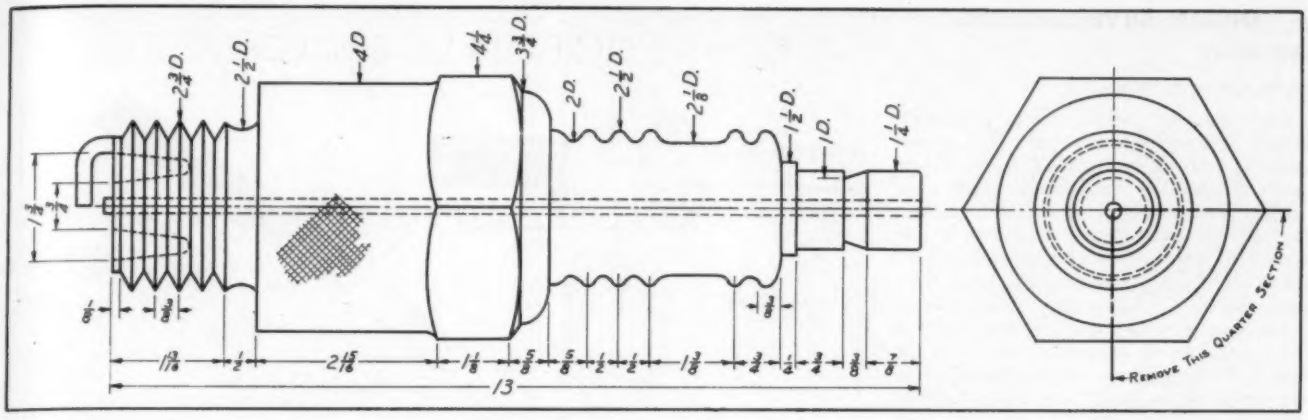
EUGENE L. DYKE
High School
Modesto, Calif.

Material

No. of pieces	*Name*	*Size*
2	Sugar pine	1¾ x 5 x 14 in.
2	Sugar pine	¾ x 5 x 14 in.
1	Brass rod	¼ x 12⅞ in. long
	Sandpaper	
	Enamel, white, black, and red	
	Paint brush	
	House screen	
12	Brads	



Cheese and cracker dish



Sparkplug (champion) mock-up

Procedure

1. Joint stock.
2. Saw 3/32-in. deep groove in center of 1¾-in. pieces lengthwise.
3. Glue 1¾-in. pieces together, line up saw kerfs.
4. Glue ¾-in. to sides of 1¾-in. pieces.
5. Square stock to size.
6. Lay out hexagon and saw to shape.
7. Turn stock in lathe to shape.
8. Saw ends to length and sand.
9. Bore 15/64-in. hole through plug, using saw kerf as guide.
10. Saw quarter section lengthwise from plug.
11. Bore 15/64-in. hole for base electrode.
12. Cut house screen and brad to plug to represent knurl.
13. Paint interior and exterior.
14. Install brass rod for electrodes.

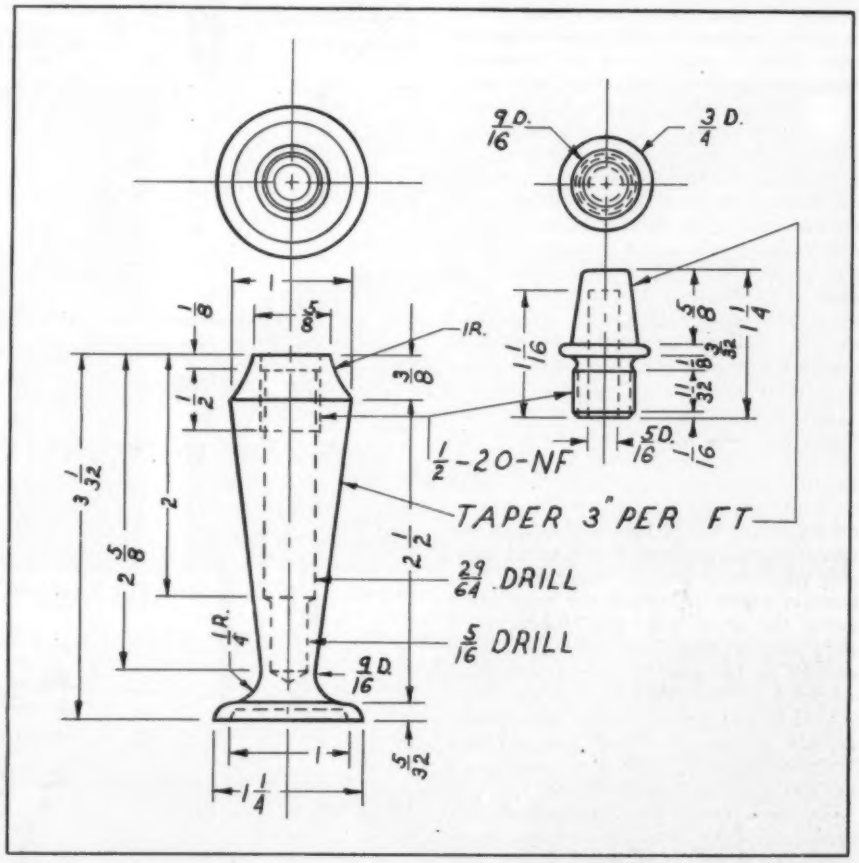
A METAL SALT AND PEPPER SET — TURNING PROJECT

DONALD ZIEGLER

Bloom Township High School

Chicago Heights, Ill.

The salt and pepper set described here is an interesting and attractive project which will prove challenging for either the home-shop machinist or the school-shop metal turning class. The original set was made of monel metal which, if properly polished, provides a beautiful and lasting finish.



If the body is made first, it will be found advisable to chuck about ½ in. of a 3¾-in. piece. The outside may then be turned after which it is drilled and threaded. The threads are cut with tap and die. A short relief in the entrance of the hole is preferred in order to insure a close fit of the two mating parts. The inside may be bored on a taper corresponding to the sides if the machinist chooses. This would make the project more difficult but will lighten the shaker considerably. After the body has been shaped and polished, it is cut off at the proper length, reversed in the chuck, and the bottom recessed.

The head is the most difficult to make of the two pieces. The stock may be cut almost to length and the threaded end turned first. A neck at the shoulder will provide thread clearance, after which it may be threaded and drilled for maximum lightness. In reversing the piece it may be chucked on the threads if brass protection is used. It can be held in a ½-in. collet or screwed into a specially tapped receptor. After the taper is turned the holes are drilled. In order to insure they would be concentric with the axis of the head, the writer scribed a circle, 7/32 in. in diameter, using a sharp pointed tool, just deep enough to hold the drill in place when drilling is begun. This is polished off after the drilling has been completed. A 3/64-in. drill for the salt and a 1/32 for the pepper shaker head, has been found satisfactory. Three equally spaced holes were used on the salt shaker head, while five were used on the pepper shaker head, one of them being in the center. A fast speed is essential for the drilling operation. The corners of the head are next slightly rounded and it is polished, using fine emery cloth and oil or other suitable abrasive.

INDIAN SILVERSMITHING

BEN HUNT

Hales Corners, Wis.

Some amateur silversmiths are fortunate enough to live where cut and polished turquoise is available and some can and do buy pieces of uncut or rough stone. Some have lapidary outfits to cut and polish the stones, and then there are those who are at a loss as to how they can cut and polish turquoise and other stones without buying new equipment. Names of dealers in cut and polished stones were given in a previous article and if you would like to try cutting and polishing with little or no outlay of equipment, here is a way it can be done. Even with a lapidary outfit in the next room I often cut and polish stones in this fashion when it is too much bother to get the outfit ready and clean up again for just one or two stones. All of the stones (turquoise) used in the neckerchief slides shown on page 356 of the November, 1950, issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION were cut in this manner.

Most of the work is done on a small hand power grinder similar to the one shown in Figure 1. A power grinder as a rule runs too fast. Turning the hand grinder with one hand and manipulating the lapstick with the other hand works very well, and it does not throw water all over the room. A metal splash guard could be made readily but this article is to describe a very simple method. Those who have no grinding wheel, may use a medium rough abrasive cloth or paper such as aluminum or carborundum, tacked to a board.

Figure 2 shows some rough turquoise. Pick out a likely looking piece and grind off one side. This is to be the base or bottom. If you are careful you can do this dry, but a wet wheel prevents heating the stone so as to become too hot to hold, and it may also discolor or crack the turquoise. Wet the wheel using a sponge or a squirt bottle, such as is shown in Figure 1. Holding the rough stone against the wheel with your fingers, grind off as much as you think will make a good base. To do this, use the face of the wheel and finish on the side, to get it quite flat. Don't turn the grinder madly. Just take it easy and wet the wheel every now and then. Too much water will, of course, cause splashing. You will soon get the knack.

The stone should now be fastened to a lapstick, although this is not always necessary. Wood dowel rod, or wood skewers may be used for lap or polishing sticks. Ordinary red sealing wax answers well for cementing the stone to the lapstick. See Figure 4. The reason for applying the wax to the stone first (No. 2 in Fig. 4) is that this procedure will give better adhesion to the stone. The finished lapstick is shown at 6 in Figure 4. Let the sealing wax cool before starting to polish.

With the rough stone on the stick proceed to grind it down to whatever shape you desire, using the face of the wheel as shown in Figure 3. First grind away the high spots and gradually shape it up. A coarse wheel cuts faster than a fine wheel and an ordinary small grindstone such as one finds on farms is ideal as they usually run in a trough of water.

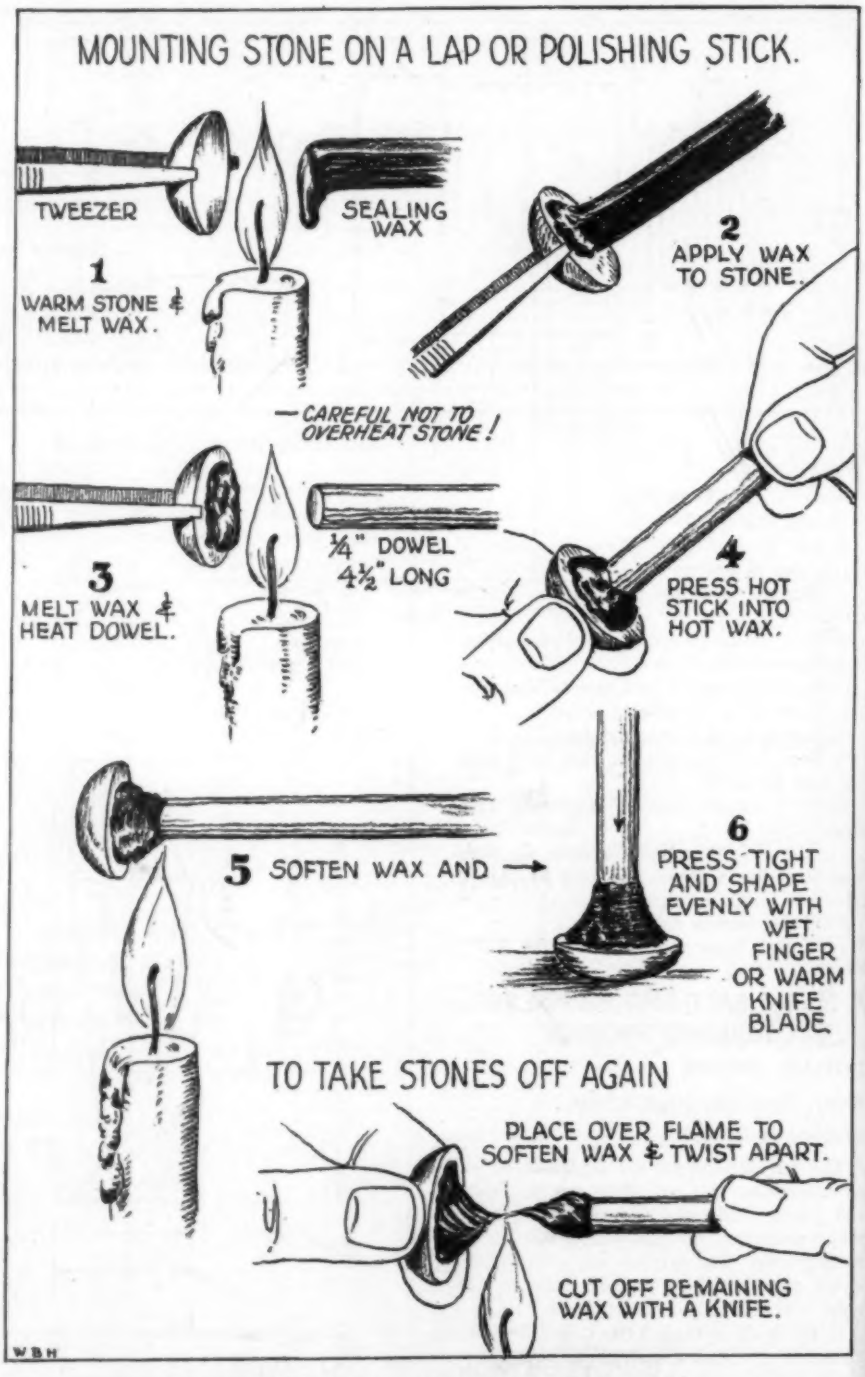

MOUNTING STONE ON A LAP OR POLISHING STICK.
TWEEZER
SEALING WAX
1
WARM STONE & MELT WAX.
2
APPLY WAX TO STONE.
— CAREFUL NOT TO OVERHEAT STONE!
¼" DOWEL 4½" LONG
3
MELT WAX & HEAT DOWEL.
4
PRESS HOT STICK INTO HOT WAX.
5 SOFTEN WAX AND →
6
PRESS TIGHT AND SHAPE EVENLY WITH WET FINGER OR WARM KNIFE BLADE.
TO TAKE STONES OFF AGAIN
PLACE OVER FLAME TO SOFTEN WAX & TWIST APART.
CUT OFF REMAINING WAX WITH A KNIFE.
WBH

Fig. 4. Method of mounting stone on the lapstick

A word here about shapes. Unless you decide on some definite shape, the rough stone usually determines the best economic shape; that is, without grinding away a lot of good turquoise. It may be round, oval, square, oblong, or triangular, or any other pleasing shape. The idea is to get as much good stone out of the rough piece as possible with a minimum of waste.

When the stone is roughed out to where it has nice looking lines, it is ready for the next step. This also may be done by more than one method. You can rub the stone on a sheet of 180 grit abrasive cloth placed on your knee (Fig. 5), and work it back and forth, or you can use a *sandpaper stick* as shown in Figure 6. This stick is about 1½ in.

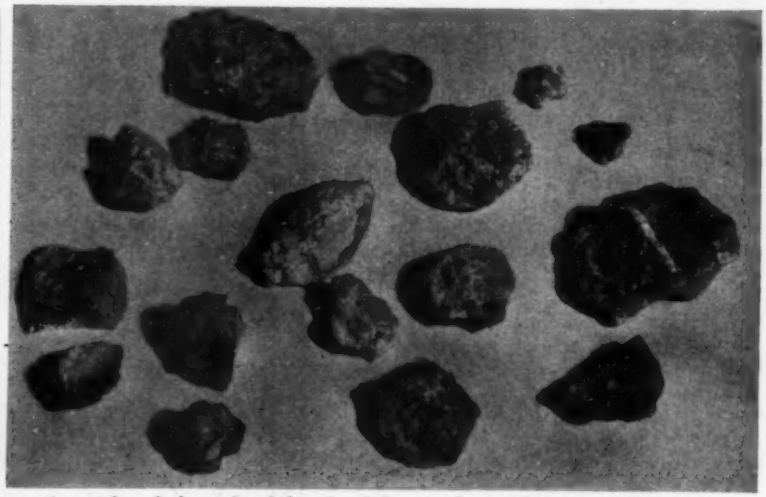


Fig. 1 (Left). Rough grinding flat base. Use the side of the wheel for final flat surface. This is a 4-in. Carborundum wheel. Fig. 2 (Right). Pieces of rough turquoise

Fig. 3. Stone on lapstick. Rough grinding to desired shape.

Fig. 5. Finishing grinding with 180-grit abrasive cloth held on knee

Fig. 6. Finish grinding with 180-grit abrasive cloth tacked onto stick over sponge rubber

Fig. 7. Polishing with creamy paste of tin oxide on piece of heavy buckskin or other soft leather

wide and 10 to 12 in. long. A piece of sponge rubber is fastened to the stick and the abrasive cloth is tacked taut over that. Either way works out satisfactorily.

Smooth down the stone to a uniform surface. As you use the abrasive cloth, it gradually wears down and the cutting action becomes slower, but finer. In other words, your abrading device becomes quite smooth.

Now for the final polishing. There are also several methods of polishing. I have used a heavy strip of canvas and also a strip of heavy buckskin. Figure 5 shows how the buckskin or polishing cloth is used. A paste of tin oxide is first worked into the buckskin. One end is tacked to the edge of a table or clamped in a vise, and the other end is pinched together. The stone, still on the lap-

stick, is rubbed vigorously back and forth in the trough thus formed. Keep turning as you rub and in a few minutes the stone will have a beautiful high polish.

Remove the stone from the stick by heating it as shown at the bottom of Figure 4, and twist it loose. Then cut away the wax left on the stone with a knife. Prying the stone loose with a knife may chip it, especially if the turquoise is of the soft variety. Malachite can also be handled in this manner as it has about the same degree of hardness as turquoise.

When grinding and polishing flat stones, the fine grinding on 180 grit abrasive is done by tacking the abrasive on a flat hardwood board, ***without having any rubber beneath it.*** Likewise the polishing buckskin or canvas, for the final polishing, is also stretched and tacked on a smooth hardwood board.

PLASTIC UTILITY DISH

KENNETH L. FOLGER
High School
Mantua, Ohio

The plastic dish, illustrated and described in this article, is an ideal project for beginning shop or craft classes. The dish may be used for mints, candy, or nuts, or as a dessert or relish dish. Made of Plexiglas, it is a popular item and does not require much equipment, or consume much time in the making. It involves the processes of sawing, sanding, buffing, polishing, heating, and forming. Larger sizes may be made by increasing the sizes given. If that is done the forming jig must also be made proportionately larger.

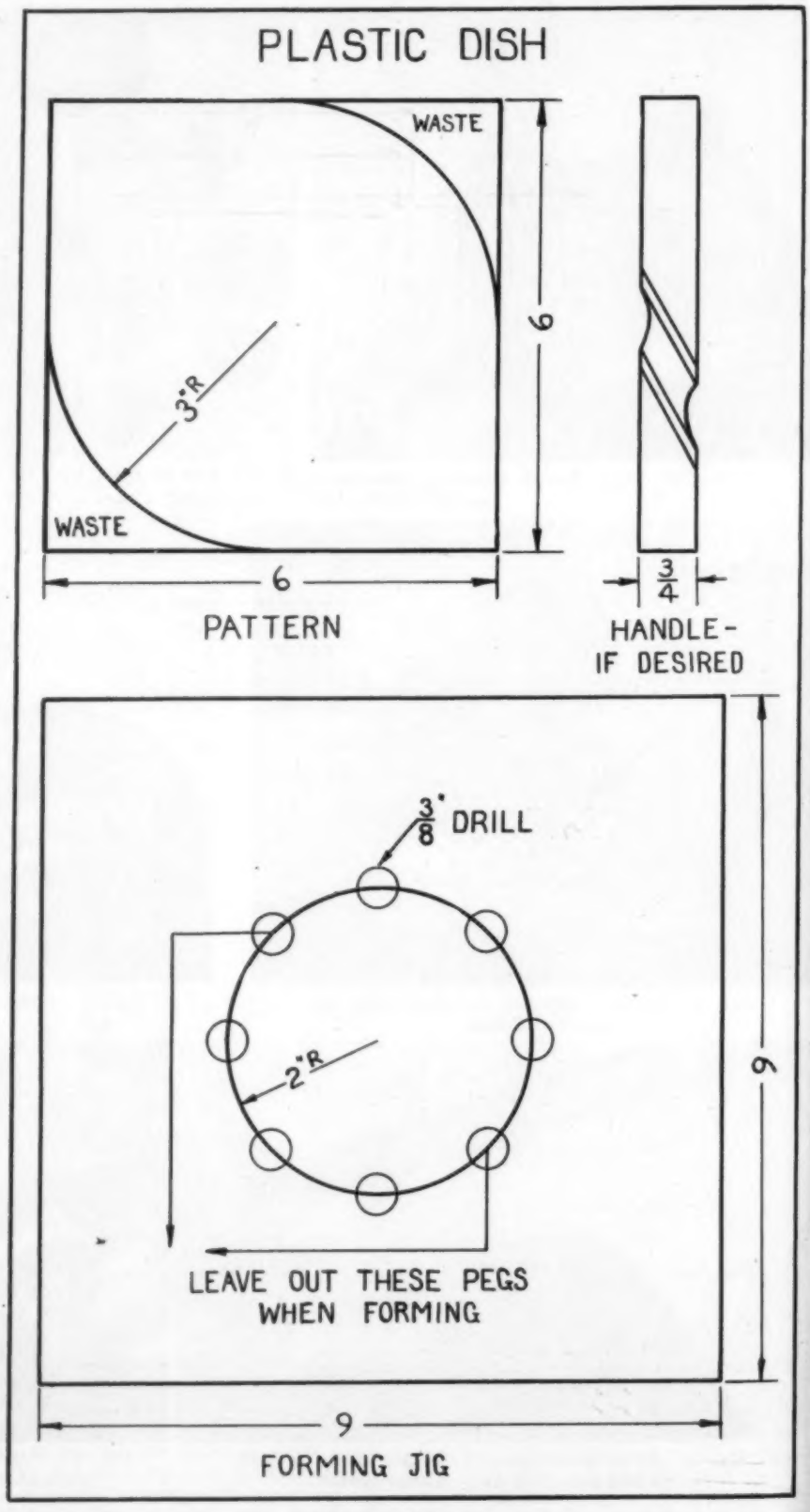
Using ⅛-in. Plexiglas of any color desired (fluorescent red is beautiful), lay out a 6-in. square. Find the center and using a compass, strike 3-inch arcs on two opposite corners. Saw out the figure just formed with coping saw or jig saw.

Sand the edges smooth, using several grades of sandpaper such as one-half, 3/0, 6/0, until there are no scratches. These edges may be then buffed and polished, using a plastic buffing compound and power wheel, or if desired, they may be left sanded only, with a frosted finish.

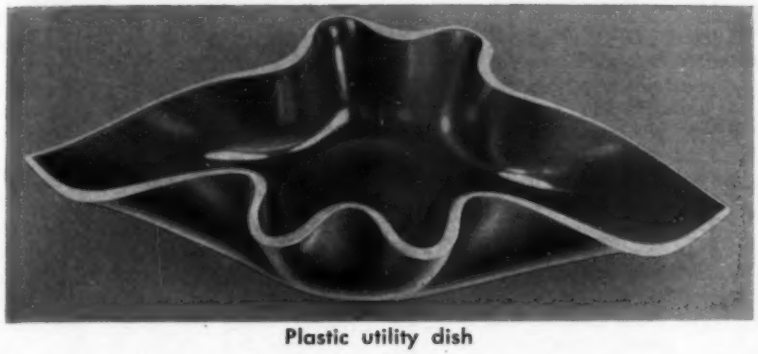
Make a forming jig from a piece of scrap lumber about 9 by 9 in. On a 2-in. radius, lay out positions for eight holes equally spaced. Bore ¾-in. holes and cut dowels about 3 in. long. Smooth both board and dowels. This jig may be made for larger dishes by boring more holes on larger radii.

Leave out two pegs toward opposite corners. Heat the plastic on an asbestos sheet in an oven set for just under 300 deg. Place in the jig with sharp corner points in corners where pegs are missing. Shape by hand and eye until uniform. The result will be a boat type dish, with a scalloped, light-holding edge, and graceful curves throughout.

If a handle is desired, cut a piece ¾ by 6 in. of the same material. After sanding and buffing, heat to form two twists near the



Plastic utility dish



Plastic utility dish

center; then shape the ends to fit the dish at the center curve of the sides, and cement in place, using any good Plexiglas cement such as Menthylene-dichloride.

The cost of this project is small, the value of process learning and experiences is great, and the result is an item that is quite pleasing.

TAP WRENCH

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Vocational Instructor
Illinois State Reformatory
Sheridan, Ill.

The tap wrench described in this article is a project which not only has a functional purpose, but it is easy to make, and includes a variety of operations. It also has the value of repetition, there being two of each part. The student will get lathe and drill press practice, and either milling machine or shaper practice, or both. It offers problems in layout and in the setup and operations of the machines.

Variations of the tap wrench specifications are possible. For instance, if a 5/16-in. radius concave milling machine cutter (for the ends of the jaws) is now available, you may have a larger radius cutter which will work equally well. If no concave cutter is available the corners may be chamfered, broken, or rounded by means of a grinding wheel. The groove may be cut on the shaper or milling machine or it can be filed by hand. The threads on the handle may be cut on the lathe or by hand.

The material is cold rolled steel. It is not necessary to harden the jaws but it is advisable since if it is not done the grooves will wear with use. The wrench may be given either a polish or a blued finish. While the polish may look better, bluing the parts will prevent them from rusting.

The wrench is assembled by passing the threaded shank through the 3/8-in. drilled hole of one jaw and screwing it into the threaded hole of the other jaw. Arrange the jaws so that the grooves face each other. The square shank of a tap fits into the grooves when the handles are tightened.

This project is not too difficult for the beginner in machine-shop practice and its completion will be very satisfactory, thereby helping to establish the feeling of accomplishment.

HAND MIRROR

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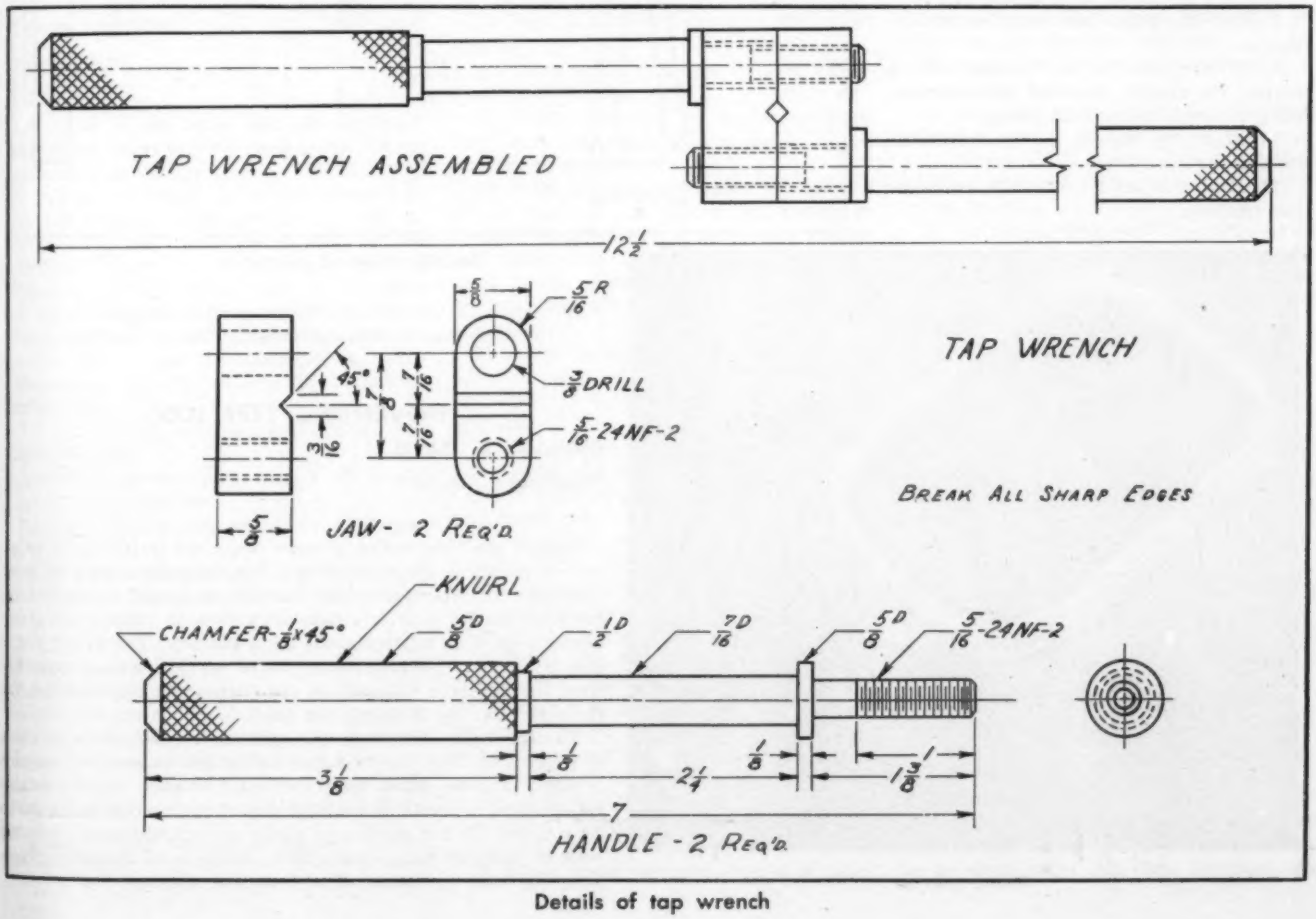
Industrial Education Department
The A. & M. College of Texas
College Station, Tex.

Perhaps the most widely used dressing aid is a mirror. Utility is combined with beauty when these mirrors are framed in designs of clear Plexiglas or Lucite. Either square or



Details of tap wrench

round mirrors lend themselves to any type of holder arrangement.

A feature of the hand mirror shown and described in this article is the double face which makes it convenient to grasp and pick up either way. The frame is of such construction that the mirror surface need never be scratched. The handle is firm fitting which makes this an easy dressing accessory to hold. It is simple to make and pleasing to own and use.

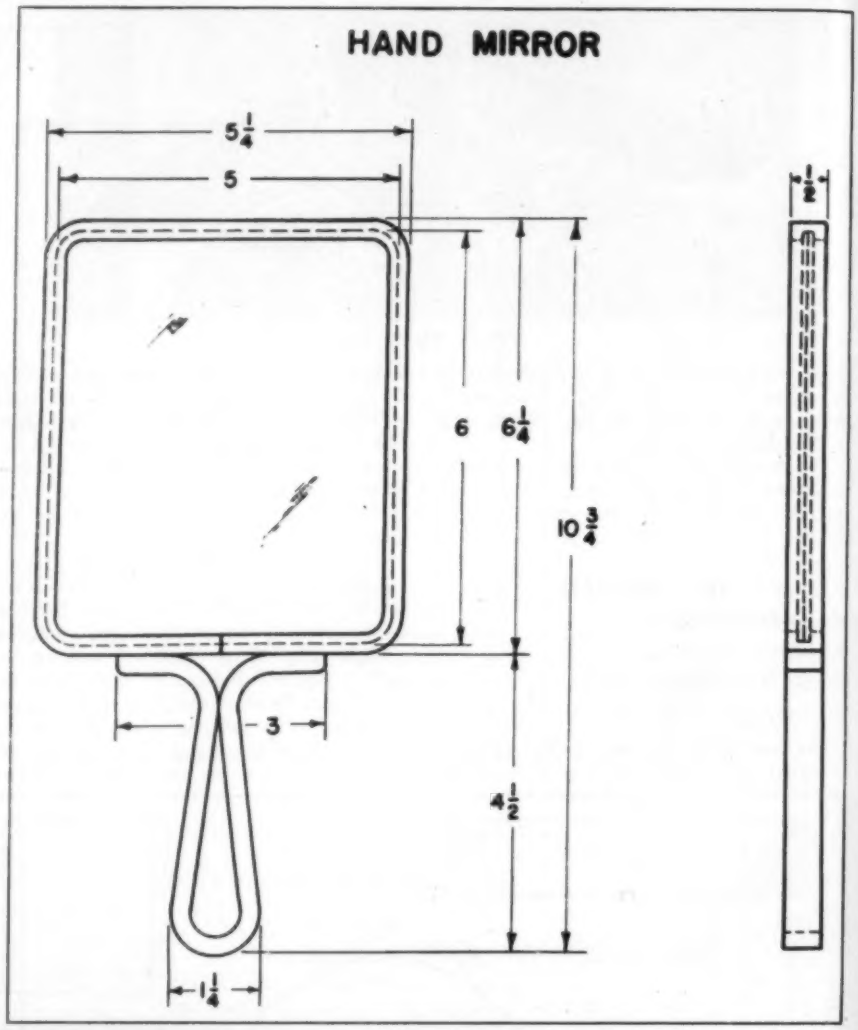
The design of the handle might be altered to conform with a dominant pattern repeated in other dressing table items, but care should be exercised to keep the construction strong enough to support the weight of the mirror adequately.

BILL OF MATERIAL

Quantity	*Material*	*Name*	*Size*
1	Plastic	Frame	¼ x ½ x 23
1	Plastic	Handle	¼ x ½ x 13
1 or 2		Mirrors	5 x 6
	Plastic cement		

Procedure

1. Lay out all parts on Plexiglas or Lucite.
2. Cut out the parts with a band or circular saw.
3. Plane and file the edges.
4. Sand the edges.
5. Buff the edges.
6. Cut the groove in the frame for the mirrors with a circular saw.
7. Dress the groove with sandpaper.
8. Heat the frame and bend around the mirror.
9. Fit the joint at the bottom of the mirror. The mirrors should be removed while filing and making the final fitting.
10. Place the mirrors in the frame and cement the joint.
11. Heat and bend the handle to a full size template.



Details of hand mirror

Hand mirror

12. Attach the handle to the frame with cement.
13. Apply a coat of wax and polish with a soft cloth.

PREVENTING TYPE LOSS

BERNARD A. DAVIS
Washington, D. C.

Perhaps the most vexing problem which the instructor of printing encounters is the maintaining of an adequate supply of type. Whatever the reasons are that lead the adolescent to deplete his case, the teacher finds it a difficult problem to replace the sorely needed type when appropriations are inadequate. The writer, therefore, sought and finally devised a means which is most comprehensive. Its success is achieved by transferring the responsibility for the type from the teacher to the pupil.

To begin with, each student is given a case for which he alone is responsible. The case to which the student is assigned contains a supply of type which meets two requirements: (1) it contains enough type to meet the needs of any of the lessons that have to be set, and (2) the number of pieces of each character conforms with an accepted font scheme ratio. There is no necessity, therefore, for boys to borrow type from one another.

A chart is displayed which shows a picture of the case showing in black letters where the characters belong, and beneath each black letter, in red, and within the particular compartment of the character, is a number which tells how many pieces should be in the student's case.

On the very first day that the student is introduced to his case, the chart on the wall is explained. The pupil learns that he has 30 lower-case *e's* in his case, 25 *i's*, etc. — the student can check and will find it to be so — and that he is responsible for having the designated number of pieces of each character at the end of the term. About five days before the last day of the term the pupils are asked to get their cases in order. When the pupil is finished the instructor should find it a small matter to give the case a cursory check. To be sure, the student will report the loss of about five or six pieces of type (which should be replaced for the incoming students) but this is a negligible and excusable loss and can be overlooked by the teacher.

The writer has found from experience that the pupil who believes that he will have to pay for missing type and knows that his grade will be affected too, will take extra precaution in preserving his supply of type.

SAFETY IN THE WELDING LABORATORY

LOUIS BAROCCI

High School

Cudahy, Wis.

Because of the many elements of danger in welding, every student must have adequate instruction in the operation of equipment and in safety precautions before he attempts to do any welding. "Although there is little or no danger of electrocution when doing electric welding,"[1] there are other dangers, such as exposing the unprotected eyes to the glare of the welding torch; exposure of the body to burns produced by hot metal, and sparks. To protect himself and his classmates, the operator must carefully observe the following safety rules.

1. Put on dark welding goggles before you light the torch.
2. To ignite the torch, always use a gas lighter, never matches.
3. Open valves and regulators on a gas cylinder slowly.
4. When you have a burning torch in your hand, turn it slowly. Be certain that nothing is in the way.
5. No matter how long it has been known to be empty, never start welding on an empty container. Make certain that it does not contain flammable liquids such as kerosene, benzine, naphtha, or gasoline. A container which has been used for such flammable materials, must be filled with water several times. Next fill it with water to which some sulphuric acid has been added. Leave this solution in the container for about one-half hour; then empty it and fill it again with fresh water; otherwise the acid left in the can may corrode the inside. After you have drained the water, you may attempt the welding.
6. Never leave a burning torch. A draft may blow out the flame; gas will escape causing an explosion when the torch is lighted again.
7. When quitting for more than five minutes, always shut off the cylinder valves. This is necessary because one is never sure that the torch and the hose leading from the tank to the torch are free of leaks.
8. Never allow oxygen to come in contact with oil or greases.
9. Never attempt to transfer gas from one cylinder to another.
10. Always refer to gases by their right names. Do not refer to oxygen as "air," or acetylene as "gas."
11. Never use oxygen as a substitute for compressed air in pneumatic tools.
12. Do not tamper with safety devices, or cylinders, or cylinder valves.
13. Do not let hot slag fall on combustible material or on the cylinders. To avoid this, work far enough away from the cylinders.
14. To prevent cylinder's being knocked over, fasten it with a chain or some other suitable material.
15. When moving a cylinder, always close the cylinder valve.
16. Use and store cylinders with valve end up.
17. When opening oxygen cylinder valves, never use a hammer.
18. When connecting an oxygen regulator, make sure that there is no grease or oil on your hands or gloves.
19. When opening an oxygen valve to blow it out, stand to one side of the opening to prevent the possibility of the oxygen striking oily clothing and igniting it.
20. Before opening the tank valve, always be sure that the regulator screw has been released.
21. After connecting the regulator to the acetylene tank, be certain that there are no leaks. If a leak is present, call the instructor.
22. If you cannot locate a leak, use soapy water made with castile or ivory soap.
23. Never attempt to repair a leak with the tank valve open.
24. When you finish the work, close the acetylene valve first — next the oxygen valve at the blowpipe; then close the tank valve and open the needle valve of the blowpipe. Finally, release the regulator valves.
25. When you finish the work at the end of the period, close the tank valve and release the pressure from the gauges. Be sure to open the needle valves or blow pipes before you reduce the pressure.
26. Use no oil at any time. No lubrication of the apparatus is necessary.
27. When changing tips, always use the tip wrench. Do not use the pliers.
28. Never repair damaged hose with tape.
29. In case of fire, shut off the blowpipe at once.
30. Never allow the acetylene flame to come in contact with cement floors, as it is likely to crack off the surface cement, scattering it with considerable force.
31. Handle a lighted blowpipe carefully. Know in which direction it is pointing.

Electric Arc Welding

1. "Wear a mask, protecting your eyes and face; also suitable clothing protecting all parts of your body from the rays of the arc, and hot metal sparks.
2. "When changing electrodes, keep yourself insulated from the ground and metal objects near by.
3. "Protect other persons from the arc rays with a shield; warn them to avoid looking at the arc.
4. "When persons working near by are unprotected by a shield, advise them to wear protective goggles.
5. "Make welding machine ground connections direct to the ground whenever possible. When connecting to metal structures, make sure a fire cannot be caused at some distant point.
6. "Wear a leather apron whenever one is available. Pants should have no cuffs and should extend down over the shoes.
7. "Always have pliers or tongs handy to pick up work which has been welded as it retains considerable heat for some time. Severe burns can be received from *black hot* iron as well as from *red hot* iron."[2]
8. Always use noncombustible material to support your work.
9. When hammering scale, use clear glass goggles to protect your eyes.
10. Always keep power lines to welding machine overhead, out of reach of anyone on the ground.
11. Before starting welding, secure proof that the container is free from explosive vapors. Never let the flame touch a container that may be sealed or plugged up so that expanding gases cannot escape.
12. Whenever the possibility of a fire exists, keep a fire extinguisher handy.[3]

[1] *Manual of Safety Instruction for Vocational and Industrial Arts*, The Fine Arts Press, Santa Ana Senior High School, 1937, p. 45.

[2] Safety Instruction Card No. 68. National Safety Council, Chicago, Ill.

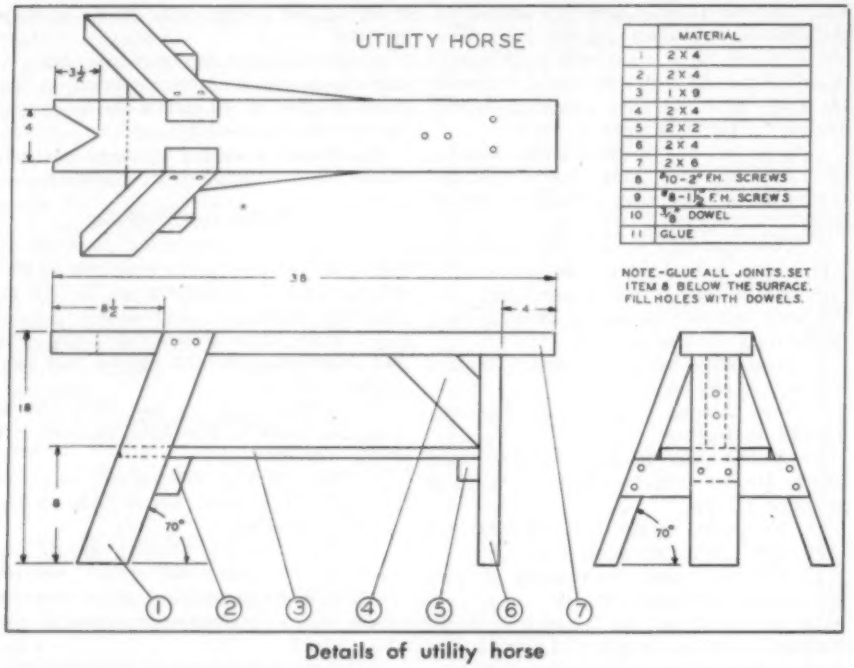
[3] *Manual of Safety Instruction for Vocational and Industrial Arts*, The Fine Arts Press, Santa Ana Senior High School, 1937.
Harry Dexter, "General Shop Safety Instructions," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 27, (Jan., 1938), pp. 21–23.
Safety Instruction Card No. 99, National Safety Council, Chicago, Ill.
Manual of Safety Instructions for Vocational and Industrial Arts, The Fine Arts Press, Santa Ana Senior High School, 1937, pp. 40–44.

UTILITY HORSE OF UNIQUE DESIGN

ALBERT M. WILKINS

Barrington, Ill.

Wooden sawhorses are so old that it might seem that nothing new could be devised to improve this common fixture that is so useful in every home and shop. However, the



Details of utility horse

usual and most used design has two great faults. It requires considerable storage space when not in use and must have a flat surface upon which to rest for stability.

The one shown and described in this article is easily stored in a small space because it will stand solidly upon its end and the three point design provides stability on a wider range of floor surfaces.

The materials required to construct this utility horse consist of 8 feet of 2 by 4, 2 feet of 2 by 2, 38 inches of 2 by 6, 3 feet of 1 by 9, 13 No. 10–2-in. f.h. screws, 4 No. 8–1½-in. f.h. screws, 1 pc. ⅜-in. dowel and waterproof glue. A bench saw, brace and bit, and a screw driver are the tools required. A handsaw may be used if a power saw is not available.

The plan has been drawn to furnish an interesting challenge to the craftsman's skill and imagination as well as to make wide use of the versatility built into the bench saw. It is suggested that before cutting the pieces, individual sketches of them be drawn to make certain of the proper angles which will provide good joints.

A carefully made utility horse will be a very useful adjunct to every home and shop. Its construction will afford the builder much pleasure.

A TIN CAN SPRINKLER

DELBERT A. DYKE
Associate Professor, Industrial Arts
Middle Tennessee State College
Murfreesboro, Tenn.

Seasonal projects are difficult to find as a rule except for Christmas time. In the spring why not suggest something useful for the vegetable or flower garden? Many sections of the country have clubs that sponsor good gardening practices. The water sprinkler is one of several projects that can be employed to a great advantage at this season of the year.

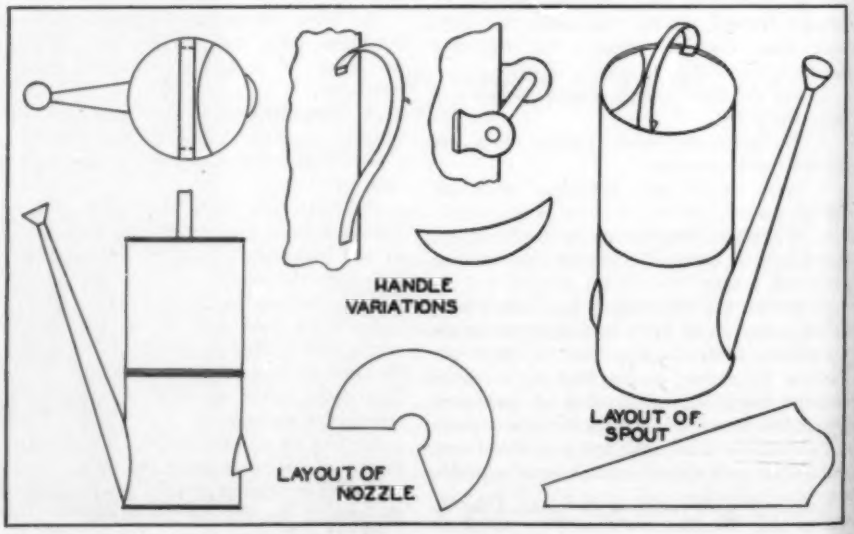
Types of handles and spout nozzles on tin can sprinkler

This project was not designed for production type training in sheet metal, as was the tin can wastebasket, published in the December 1947, issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION page 420. However, it does include a wide variety of operations usually found in a sheet-metal course. It was designed to permit an expression of individual differences in ideas of proportion, and color.

Surprisingly good results are obtained occasionally by presenting an idea to a group of students, and letting each individual work out the construction details, proportion, and design of each part. The water sprinkler proved to be such a project.

A review of the simpler operations taught in a sheet-metal course such as laying out, developing of coned shaped figures, cutting with various kinds of tin snips, use of the bar folder, soldering, and metal finishing will be noted when analyzing the steps involved in making this sprinkler.

With great latitude being permitted in design and construction of appendages, variations appear in the nozzle and the handles. Some will use the top portion of small cans (baby food size), while others will design cone shaped figures for the nozzle. In the handles, there should be an expression of individual differences, as will be noted in the accompanying photographs. The body of the sprinkler is made of two number ten cans (gallon cans) butt soldered together. In the drawing, details of the best points of the entire experiment are shown.



Tin can sprinkler

END TABLE

ROY A. GARRIGUS
Brazil, Ind.

This type of end table can be made with hand tools, except the sawed kerfs that are used as a decoration on the legs.

This table is an excellent project for junior high school students.

The saw kerfs are a help when fastening the table together because nails may be driven in the kerfs and set, and then covered with plastic wood.

A good cold glue should be used in the dado joints. It has been found best to nail the table together before rounding the tops of the legs. Be sure to let the glue dry overnight. Use 60 ½ carborundum cabinet paper to sand the legs level with the top, then use a wood file to round the top of the legs as indicated in the drawing, then sand.

The height of this table may vary. The table should stand about 2 in. lower than the height of the arm of the davenport with which it is to be used.

BILL OF MATERIAL

Number	*Name*	*Size*
2	Tops	⅞ x 13 x 19
4	Legs	⅞ x 1½ x 20⅞
	Finishing nails	1½ inch

TEACHING HOME MAINTENANCE THROUGH THE SCHOOL SHOP

ERNST H. SUERKEN
Supervising Principal
Union Free School District, Greenburgh Number Eleven
Dobbs Ferry, N. Y.

The student of today will be the family man, consumer, worker, taxpayer, and voter of tomorrow. In many instances this also means that he will be the homeowner of tomorrow. It is suggested that the schools can make a major contribution toward preparing pupils for their roles as homeowners by teaching home maintenance through the medium of the school shop. This article will not attempt to detail lesson plans or projects on particular phases of home maintenance but it will present a timetable indicating appropriate activities which instructors can integrate into their instructional programs at appropriate times.

It has been said that a house begins to deteriorate the minute it is completed. According to the latest available reports, home-ownership is on the increase. Consequently, it is reasonable to suppose that there is some point to teaching students the difference between a leader and a trap. The purpose of such instruction would not be to teach students how to make major repairs but to teach a systematic program of checking and maintenance which would be their best insurance against the sudden crisis of an unplanned expense for an unpostponable repair.

October

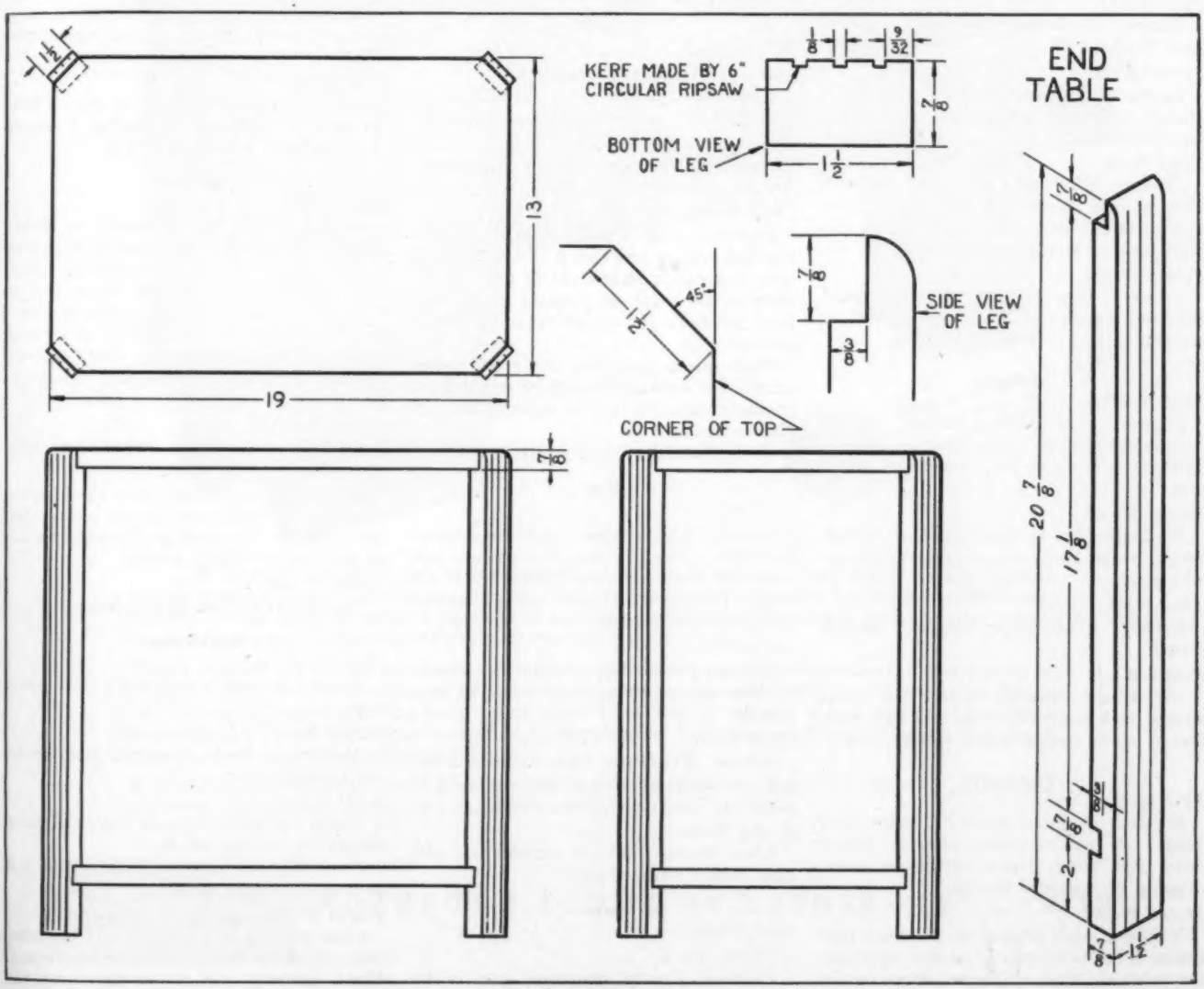
First Week:

Electric: Repair worn or frayed electric connections. Remove darkened lamp bulbs. Oil fans and motors.

Drainage: Examine connection of leaders from roof gutters to ground drains.

Second Week:

Roofing and sheet metal: Look over roof for loose slates or shingles. Clean gutters. Paint galvanized sheet metal and canvas roofing.



Details of end table

Third Week:

Drainage: See that exterior drains, area drains, and catch basins are clean.

Fourth Week:

Plumbing: Clean drain with grease removing preparation monthly.

November

First Week:

Heating: Keep oil tank at least one quarter full at all times. Don't neglect to service defective burner or stoker.

Second Week:

Windows and Doors: Check windows and doors for broken glass, defective putty, broken cords.

Third Week:

Storm Sash and Screens: Remove screens and install the storm sash and storm doors.

Fourth Week:

Drafts: To eliminate cold drafts and to save fuel, weatherstrip doors and windows.

December

First Week:

Electric: Check all portable electric fixture wire. Replace bulbs.

Second Week:

Electric: Look over Christmas tree lights. Discard frayed wire. Ready fire extinguisher for Christmas.

Third Week:

Chimney: Check all flues for dirt and soot. Flues, if used, should be cleaned every three to five years. Clean ash pit yearly. Check fireplace for loose mortar, cracked bricks.

Fourth Week:

Calking: Inspect joints between wood trim and masonry at doors and windows to see that calking is in good condition.

January

First Week:

Electric: Oil all fans and motors.

Safety: Refill fire extinguisher. Dispose of dried-out Christmas tree, trash, oil-soaked rags.

Second Week:

Hardware: Fix broken locks and latches. Secure loose knobs. Spray squeaky hinges with graphite.

Third Week:

Heating: Flush steam boiler to remove deposit.

Fourth Week:

Hot Water Storage: Inspect hot water storage tank and pipe. Drips and rust from faucets mean danger. Drain storage tank.

February

First Week:

Eliminate Nuisance Noises: If water pipes bang, add water-hammer silencer. Repair noisy toilet tanks. Renew washers on leaky, dripping, or chattering faucets.

Second Week:

Heating Noises: Banging in the steam pipe system is due to incorrectly pitched pipes near the radiators. Noisy oil burners mean service is needed.

Third Week:

Continue noise abatement program.

Fourth Week:

Plumbing: Clean grease trap. An unpleasant but vital job. Clean plumbing fixture drains.

March

First Week:

Electric: Replace darkened lamp bulbs.

Screens: Paint and repair screens.

Second Week:

Vermin and Insect Protection: Look over screening in louver vents, chimney and incinerator tops and make tight.

Third Week:

Screens and Storm Sash: Take down storm sash and hang screens. Stack storm sash vertically on dry floor or in racks.

Fourth Week:

Leaks and Dry Rot: Inspect roof. While in attic look for signs of dry rot. Open all possible attic and basement vents, doors and windows to give free circulation of air to prevent condensation which causes dry rot.

April

First Week:

Electric: Oil all fans and motors.

Termites: Look on inside and outside of cellar wall for mudlike tubes the size of pencil.

Second Week:

Carpentry: Repair all damage due to leaks, dry rot, or termites.

Third Week:

Leaks: If cellar is still wet or damp after rain and you are sure that it is not condensation, look for cause of leaks as follows: (*a*) earth around house not properly sloped away from building; (*b*) clogged open-tile drains and areaways.

When causes have been eliminated, waterproof cellar walls and floors with special paint or cement-iron-cost type of waterproofing.

Fourth Week:

To cut fuel bills, install insulation.

May

First Week:

Heating: Remove smoke pipes from heater and boiler. Clean and paint. Stack smoke pipe vertically in dry location. Clean boiler and heater. This job is best done by a professional using a vacuum machine.

Second Week:

Exterior Masonry: Inspect exterior masonry for loose mortar, open joints, cracked or loose stucco.

Third Week:

Exterior Woodwork: Look for split woodwork, rotten pieces, open connections or joints, sagging or loose pieces. Make repairs.

Fourth Week:

Glass: Replace damaged windows and door glass. Repair damaged putty.

June

First Week:

Yearly Musts:

Painting: Canvas, galvanized iron or tin roofing sheet-metal work, wood gutters, steel, and defective stucco. Examine woodwork for paint needs. A good painting job lasts five to six years.

Second Week:

Painting: Finish outside painting.

Electric: Replace darkened lamp bulbs.

Third Week:

Electric: Repair frayed cords.

Fourth Week:

Heating: Clean all radiators with stiff brush or vacuum cleaner.

July

First Week:

Electric: Oil fans and motors.

Painting and Papering: Check needs for interior painting and papering. Repainting in cities every three to five years. Double interval in suburbs.

Second Week:

Furniture: Look over furniture legs to see that they won't injure floors. Should rest on gliders, not domes.

Third Week:

Flooring: Lay any required new flooring such as linoleum, cork, rubber, or asphalt tile. Wax.

Fourth Week:

Pipes: Dripping pipes may be due to condensation in warm, humid weather. Covering with insulation will eliminate drip.

August

First Week:

Heating: Check on oil burner or stoker service contract. See that a yearly inspection is made. Plant should be completely tested and parts renewed as required every four or five years. Order your fuel, including firewood. Replace smoke pipes and see that all parts of boiler and heater are airtight. Check radiator valves and replace defective ones. Open windows or vent so that boiler will get air.

Second Week:

Reminders: Repair and repaint storm sash.

Third Week:

Grease Trap and Septic Tank: Clean grease trap. Remove sludge on top and bottom. See that field tile are working. Flooded area indicates that new field is needed.

Fourth Week:

Plumbing: Clean wastes and drains.

September

First Week:

Screens: Remove screens and replace storm sash.

Second Week:

Awning and Porch Furniture: Remove all awnings and repair.

Third Week:

Shades and Blinds: Repair and clean roller shades and venetian blinds.

Plumbing: Drain outside water lines and store hose on reels inside.

Fourth Week:

Close windows and vents in attic and basement which might cause damage by freezing. Check lightning rods to see that none has been damaged.

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ENGLISH FOR TRADE AND VOCATIONAL SCHOOLS

J. ALLEN MORRIS
Murray Vocational School
Charleston, S. C.

(See preceding articles in January, September, and November, 1948; January, May, June, November, and December, 1949; and February and November, 1950, issues.)

Plural of Nouns

Omission of the letter "s" is one of the most frequent errors made in the work of vocational school students. Some boys, of course, have no difficulty with this and need no work on it; but those who have acquired this careless habit do not break it easily or quickly. Knowledge of the rule for forming plurals of nouns by adding "s" is of no value to such students; they know the rule but do not use it consistently in their work. Such boys write sentences like these: "All the *boy* in the wood shop learn how to use common hand *tool*," and "One of the *tire* on the car is flat."

If this mistake occurs several times in a boy's written work, the instructor will notice that errors in subject-verb agreement ("He *need* a new blade for the coping saw") and in forming past tense and past participial forms of regular verbs ("The five-tube set has been *repair*, but the cabinet has not been *polish*") will also be made by the same student. Occasionally these mistakes can be traced to ignorance; he just does not know any better. Normal instruction will obviate these mistakes in time.

More often, however, such errors are made because the writer "reads from his mind" rather than from his paper; he does not read what he has actually written on his paper. Instead, he reads only the first two or three letters (enough to register the sound of the word in his mind); he does not see that he has left off "s's" or "ed's" on the ends of words — because he never actually sees the ends of the words. After such a boy has been told to watch the ends of words for "s's" and "ed's," the trouble may disappear. If, after a reasonable length of time, it is still occurring, the instructor should suggest an eye examination by a competent specialist. Wearing properly fitted glasses, the boy sees his mistakes, corrects them in his work, and is no longer troubled in this particular way.

As most of the errors in forming plurals are habitual, considerable drill work must be done by the student before the habit of putting "s's" on words replaces the habit of omitting them. To provide such drill work I use several mimeographed sheets.

In the following drill paper I require all boys to do the first block, to test their knowledge of irregular plural forms. This is a separate job which has no effect on the habit of omitting "s's." Each student writes the fifty words. If he spells them all correctly, he is finished with this particular work. He is required to learn the rules and to be able to spell correctly the plural forms of all words missed. A separate explanation sheet is used to assist him in learning these rules. Any good grammar book can be used instead of a mimeographed explanation sheet if the instructor prefers a book.

Block I — Plurals of Nouns

I. Write only the plural forms of the following nouns:

box	church	woman
pony	tooth	self
half	hero	society
potato	vacancy	wharf
valley	quantity	fly
tax	monkey	shop
penny	window	trench
key	boy	wish
wife	wolf	mouse
loaf	volcano	watch
goose	trolley	library
negro	man	child
chimney	foot	donkey
glass	life	bicycle
battery	chisel	candy
book	knife	pulley
lady	country	

The second block of the drill is so constructed that it gives practice in putting "s's" on nouns to make them plural and at the same time tests several rules of punctuation and capitalization. The other blocks (III–VIII) are self-explanatory. Each helps to stress the idea of using "s's" to form plurals and supplies practice that is essential.

II. Rewrite the following sentences, correcting all the mistakes:

the three brother spent two hundred dollar for an old ford they took off the four tire removed two of the door painted the four fender and sewed up several hole in the upholstery when they had finished these job they asked several friend to help them make the other repair that were needed two other boy offered to help them the five boy took many part of the engine into their garage when they had cleaned all the part they put them back in about thirty-six hour the old car was ready to be tested the boy all climbed into it and started the motor after a few cough and a few jump the car stopped the boy started it again and it ran all right for about ten block then it stopped again the boy checked all their job and all the thing seemed to be properly done then one of the boy found out why the car would not run it was out of gas

III. Write 25 *plural nouns* (nouns ending in *s*).

IV. Write the plural forms of 25 different tools, machines, or instruments used in your shop.

V. Use each of the words written for Block IV in one sentence.

VI. Get a magazine or book related to your trade, and copy five sentences containing *plural forms of shop terms.*

VII. Write the numbers from two to twenty-five, using plural nouns after the numbers.
Examples: two chisels — three hammers — four bicycles, etc.

VIII. The following ten words are *verbs* (not nouns). They are *plural verbs* (verbs that do not end in the letter *s*).

eat	believe	run
receive	chisel	fight
plane	see	swim
separate		

Use each of these plural verbs in one sentence. Add a *plural noun* to each as its subject.

My method of using drill work is as follows: for each error made by a student, one block of work is assigned, written, corrected, and recorded on the boy's work card. In addition, as a result of writing, for example, "All my *brother* were in the Coast Guard," the boy is made to write "brother*s* were" a number of times (10–15–20–25), the number increasing as mistakes of this kind continue to appear in his written work. This "make-up work" focuses his attention on his weakness and helps to bring closer the day when he stops making this kind of mistake.

If the error persists after Drill I has been completed, I check the boy's reading ability, knowledge of rules, and methods of checking his work. If I believe that his eyes are responsible for his trouble, I recommend an examination by a specialist. Often this is the end of his trouble with plurals. If, however, he merely needs more drill work, he is given the following:

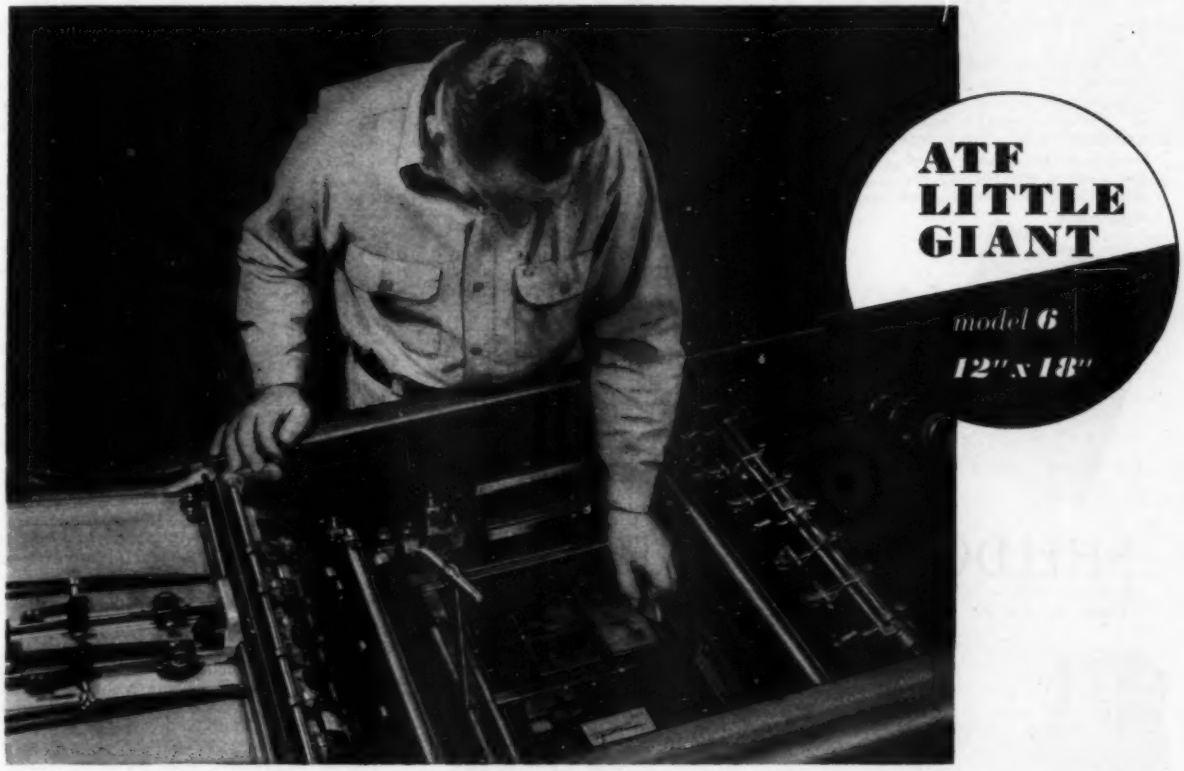
Plural Forms of Nouns (II)

I. Read carefully the following sentences, and notice how silly the plurals look without the plural ending (s). Rewrite each sentence, adding "s" to each of the plural nouns:

1. You should keep the *tire* on your car inflated. (One tire?)
2. When the bell rang, *all the worker*

(Continued on page 24A)

A natural for TEACHING PRINTING...



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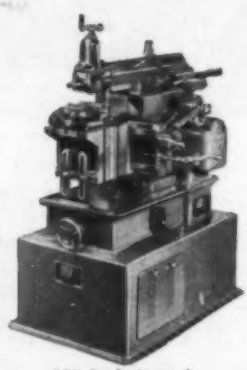


12" Back Geared Shaper

ASSOCIATION NEWS

(Continued from page 6A)

KANSAS INDUSTRIAL EDUCATION ASSOCIATION

The 25th annual meeting of the Kansas Industrial Education Association was held at Topeka, Kans., on November 3, 1950.

Ralph O. Johnston, industrial-arts instructor, Anthony High School, was chairman of the first session on Friday morning.

The main address at this meeting was given by Merton C. Wheeler, supervisor of industrial education, state department of education, Jefferson City, Mo. The theme of the address was "Adjusting the Industrial Education Program to Meet the Needs of Our Times."

At the business meeting, H. D. Horton, instructor of auto mechanics, High School, Wichita, Kans., was elected president for the coming year, and John Anderson, industrial-arts instructor, High School, Nickerson, Kans., vice-president.

Kenneth R. Powers, instructor of auto mechanics and driver education, High School, Topeka, Kans., was elected secretary-treasurer.

Dr. M. D. Mobley, the new executive secretary of the American Vocational Association, was the main speaker at the afternoon session. His subject was "The Importance of Industrial Education in the Total Education Program."

The panel which discussed "School Shop Safety" consisted of Homer Templin, St. John, Kans., leader; and Howard Anderson, Topeka; Paul Bunn, Sterling; and Archie Asher, Effingham.

EPSILON PI TAU ACTIVITIES

Alpha Chapter of Epsilon Pi Tau held its first meeting of the 1950–51 school year on December 8, 1950, at 7:30 p.m., at the University High School.

Dr. William E. Warner, the executive director of Civil Defense for the state of Ohio, described what was being done to protect the inhabitants of Ohio in case of war.

On November 4, Alpha Omicron Chapter of E.P.T. was installed at Wayne University, Detroit, Mich. Participating were delegations from The Stout Institute, Ball State, DeKalb, Buffalo, Ohio State, Bowling Green, Oswego, Kent State, Miami, and Western State. Nineteen different institutions were represented by faculty and students. The new chapter has thirty members; the officers are Ralph Bohn, president; John Prepolec, vice-president; Jack Duvall, treasurer; William Baranyi, secretary; and Gerald Baysinger, trustee.

Gamma Chapter of Epsilon Pi Tau, Miami University, Oxford, Ohio, held its initiation Friday, November 17, 1950, at the Fred Campbell Whitcomb Laboratory at 4:30. The following men were initiated: Wells Didlick, Robert Donbar, Dean A. Havenstein, Harold L. Kincer, Alan A. Kreidler, Ned L. Klumph, Allan M. Nieminen, Byron T. Neidhamer, and Wilbur K. Lewis.

Following the initiation a banquet was served at which Dr. Earnest J. Ashbaugh, Dean Emeritus of the School of Education, Miami University, Oxford, Ohio, addressed the group.

STATE OF WASHINGTON INDUSTRIAL-ARTS ASSOCIATION

The industrial-arts teachers of the state of Washington are in the process of forming a statewide industrial-arts association which should advance the cause of industrial arts a great deal in this area. Due to the natural terrain, it is being set up by having regional meetings which in turn will get together to formulate and plan a state-wide meeting.

NATIONAL ASSOCIATION OF SCHOOLS OF DESIGN

Ernest Pickering, dean of the School of Applied Arts, University of Cincinnati, has been elected president of the National Association of Schools of Design at the Association's recent meeting in Chicago.

Other officers elected are: vice-president, Kenneth E. Hudson, dean, St. Louis School of Fine Arts, Washington University, St. Louis, Mo.; secretary, Harold R. Rice, dean, Moore Institute of Art, Science & Industry, Philadelphia, Pa.; treasurer, James C. Boudreau, dean, The Art School, Pratt Institute, Brooklyn, N. Y.

The special Committee on Accreditation consists of Messrs. Ernest Pickering, Royal Bailey Farnum, and Dana Vaughan.

The Association will hold its 1951 Annual Meeting at Providence, R. I., with the Rhode Island School of Design acting as host.

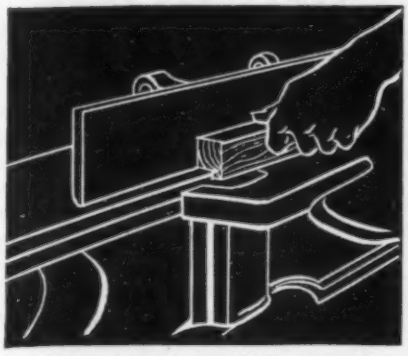
♦ Dick Kisner, woodworking instructor, central High School, Tulsa, Okla., was elected president of the Oklahoma Industrial Arts Association for 1951.

H. A. Allender, woodwork instructor, Will Rogers High School, Tulsa, Okla., was elected vice-chairman of the Industrial Education section of the Oklahoma Education Association.

♦ The fourth annual Industrial Education Conference at Iowa State College, Ames, Iowa, will be held April 20, 1951. Principal speaker for the meeting will be Harold G. Silvius, department of industrial education, Wayne University, Detroit, Mich.

♦ The National Association of State Directors of Vocational Education held a spring meeting in Washington, D. C., at the Washington Hotel on May 5 and 6. Dr. L. H. Dennis, executive secretary of the American Vocational Association, addressed the group on Saturday forenoon.

Pound price of aluminum has decreased from $545 in 1852 to only 18 cents today.



Jointing — An accurate, clean rabbet cut is assured; fence moves across full width of table to support work while rabbeting. Rabbeting capacity 5/8".

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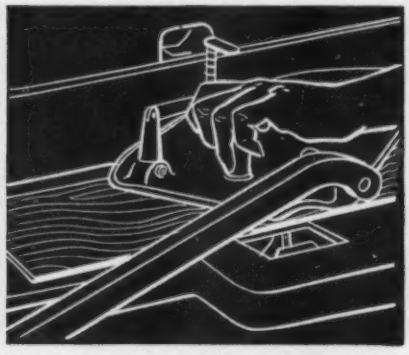

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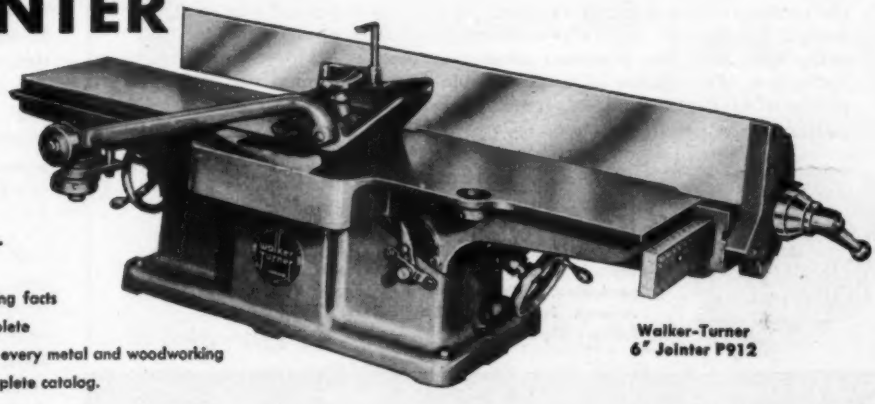

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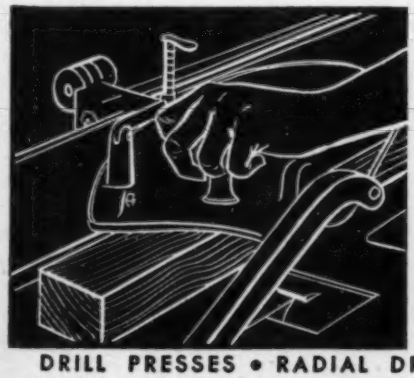
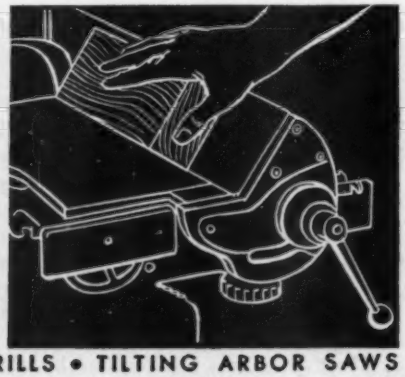
Surfacing — This is accomplished simply by exerting a slight downward Pressure. With the safety guard on top of the work, both hands are protected while stock is being surfaced.



Beveling — Big tables, designed for simple accurate depth adjustment. This operation shows beveling at 45°. Fence may be tilted to 45° in either direction.



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English

(Continued from page 20A)

went back to their machines. (One worker?)

3. The sailors signed *their name* in a ring. (One name?)
4. They have *swimming lesson* at the Y.M.C.A. *three time* a week. (One lesson?)
5. For *many year* Morse labored, but all his persuasion fell on *deaf ear*. (One ear?)
6. We fought the Spanish-American War to protect American *plantation* in Cuba. (One plantation?)
7. Electric *drill* are used to drill *hole* in wood or metal. (One hole?)
8. A man can improve his education by going to day or night school, reading *book*, or taking correspondence courses. (One book?)
9. *Two thing* that the American *colonist* learned from the Indians were how to make a deadfall and how to raise corn. (One colonist?)
10. These programs are put on by the *school* of Charleston. (One school?)

II. Rewrite the following sentences, adding the letter "s" to each noun that needs "s" to make it plural:

1. the name of the girl are jean ruth mary hazel dot and anna 2. ralph went to summerville for a few day 3. some of the tree top were under water 4. two week later i went home 5. school will open in about two month 6. the house were made of log 7. two of the boy caught seven snake 8. the farmer gave us a lot of pear and apple 9. we hauled five load of dirt from the field 10. i bought some airplane model and a set of book on aviation 11. i saw the man hauling log out of the wood 12. they picked two bale of cotton 13. i left charleston for three week 14. in those three week all i did was swim play game eat and sleep 15. many boy and girl went to the high-school dance last year

As errors in subject-verb agreement almost invariably accompany mistakes in plurals, drill sheets on subject-verb work can be used simultaneously with drills on plurals — as the mistakes occur in written work. For most boys, this will be sufficient. If not, the same general treatment continues, the student using other papers similar to Drills I and II. Any instructor can make his own drills from sentences written by his students. These are assigned, one after the other, until finally the errors disappear.

Nouns in Sentences

First-year vocational-school students need a great deal of help with simple rules of capitalization and punctuation. They may know how to talk correctly about some of the rules, but their actual written work is full of mistakes in fundamentals. As a part of the intensive program of testing, teaching, drilling, retesting, reteaching, and so on that is carried out in my classes, I have found two units on "Nouns in Sentences" very useful. They are used individually in my work but can be assigned as class exercises, using a part of "Nouns in Sentences — I" each day as a class-opening assignment. "Nouns in Sentences — II" can be used either in mimeographed form or as a dictation exercise, with instruction later based on errors made in the students' papers.

Nouns in Sentences — I

1. Name the seven days of the week and the twelve months of the year.
2. Write the names of ten makes of automobiles.
3. Name fifteen cities, using the state abbreviation with each.

4. Write five boys' names, giving first names, initials (if any), and last names.
5. Using magazines, newspapers, or memory, write the names of five business concerns, giving the full address of each as if you were addressing an envelope to each.
6. Using magazines or newspapers, write the names of five nationally-advertised products.
7. Write the names of three Charleston schools and the names of the local newspapers.
8. Write the names of the five shops in Murray Vocational School.
9. Name fifteen tools used in your shop.
10. Name ten things which you see in your shop, without repeating the names of the fifteen tools written for No. 9.

B. Write the following sentences in the form of a friendly letter:

dear jack

i am writing this letter as part of a test in murray vocational school today is (Fill in the date.) i am in the english class now in school i study the following subjects (Write the names of the subjects you are taking, including the name of your shop.) my instructors are (Write the names of your instructors.) mr john h clark is the principal

i now live at (Write your address.) my school address is 6 chisolm street charleston 21 s c please write soon

your friend
(Sign your own name.)

C. Write the following sentences:

john s hat is ruined the carpenter s work is done the children s clothes were torn the boys exhibition opens today

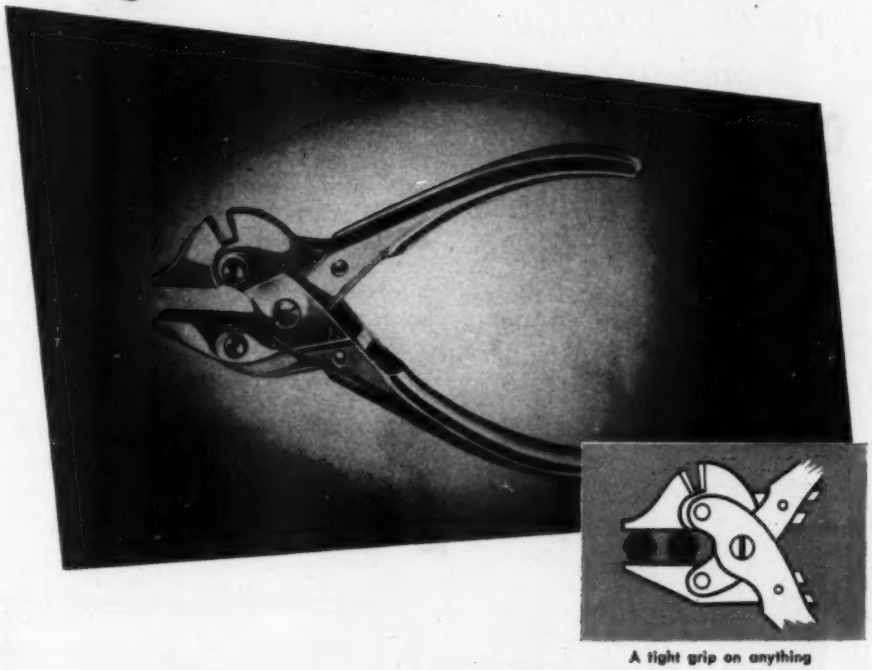
NOTE: In the first two sentences, "John" and "carpenter" are singular nouns. In the other sentences "children" and "boys" are plural nouns.

D. Write only the plural forms of the following:

child	woman	foot
story	company	lady
loaf	knife	thief
monkey	chimney	doorway
cargo	negro	motto
man	workman	tooth
city	penalty	fly
self	shelf	leaf
delay	survey	hero
echo	potato	key

Answer this question: If you do not know the plural form of a noun, in what book can you find the form that is correct?

The plier that grips like a vise...



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Nouns in Sentences — II

Write the following sentences in the form of a friendly letter. Correct every mistake that you can find:

dear tommie

i received your two letter yesterday i liked the one you sent from washington d c it must have been fun to go to the white house to see the president he must be a very busy man

three friend of yours have ask me to give them the colored stamp from all the letter you sent when you stop in different town and city in the united states and canada you must have had a fine time visiting so many place

say tommie did you like the north better than the south which did you enjoy more — the east or the west mr hamilton says he likes the north better than the south but mr douglas says the south is much better than the north

four lady from your church came to see you yesterday they wanted you to do some work in the church hall some old book are to be thrown away fifteen win-

(Continued on next page)

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Shown above is a Harper Electric Studio Kiln SK-151416 in operation at the State Teacher's College, Buffalo, N. Y. This kiln has 1½ Cu. Ft. of useful firing space and will accommodate the ware of 35-40 students. Mr. E. H. Strong, Instructor of Industrial Ceramics, at extreme right, states: "I have found the Harper Studio Kiln an ideal piece of equipment for Ceramic training in the Industrial Arts Field. I particularly like the capacity of this kiln to operate safely and efficiently in any temperature range that may be required of it."

There is a Harper Kiln to meet every firing requirement. Our Kiln Department will be glad to send you full particulars on them. Write to Dept. #3

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English

(Continued from previous page)

dow have to be clean some old broken toy are to be repair and given to a lot of crippled child at christmas and three chimney need to be fix the four lady said they can wait until you come back they said they d give you about ten dollar to do this work you can get two or three boy to help you

listen tommie when are you coming home mr aurner our scoutmaster wants you to train eight scout for the first aid contest next month we want to get started soon write mr aurner a letter and tell him when you ll be back if you stop in columbia s c on your way home remember to go to see jerry reigner he s working in a garage there drop me a line and tell me when you ll be home

your friend

. . . . . .

Both of these papers are effective in improving the quality of work handed in by beginners. They can, with a few minor changes, be adapted to the uses of any instructor who wishes to revise them for his own students.

Personal News

JOHN CLAUDE JOINS ROCKWELL MFG. CO.

John Claude has been appointed a special representative to contact the school market for Delta Power Tool Division, Rockwell Manufacturing Company, Milwaukee 1, Wis.

Mr. Claude spent 26 years with The Bruce Publishing Company selling their texts relating to

John Claude

industrial arts and trade and vocational education. He later on organized the John Claude & Associates serving schools throughout the country in an advisory capacity on school shop planning. He is a member of national, regional, and state societies devoted to industrial arts, trade and vocational education. He is listed in *Who's Who* in the Middle West.

Mr. Claude enjoys a wide acquaintance in the field of industrial arts and trade and vocational education and will contact the school field to help them in their shop planning and the best use of Delta, Multiplex, and Crescent tools.

GEORGE OLSEN CHAIRMAN OF ADVISORY COMMITTEE

George Olsen, teacher of industrial arts in Staten Island, and president of the Richmond Guild, Teachers of Industrial Arts, has been re-

George Olsen

elected chairman of the advisory committee on teachers' salaries, board of education, city of New York. — *John Hurley.*

♦ Dr. L. L. Thurstone, one of America's best known experts on psychological measurements, reports the development of a new test of personality traits, the Thurstone Temperament Schedule. Dr. Thurstone believes this new test assays the main factors that make up temperament or personality.

Additional information on this new Thurstone test may be had from the Information Department, Science Research Associates, Chicago 4, Ill.

♦ Dr. J. C. Wright, retired assistant U. S. Commissioner of Education in charge of vocational education, also served as a member of Colorado A. & M.'s teaching staff this summer.

♦ Oakley Furney, retired assistant commissioner for vocational education, New York State Education Department, served this summer as a member of the faculty of the Colorado Agricultural and Mechanical College, Fort Collins.

♦ Alexander Hanel, instructor of pattern-making at the Boys' Technical High School, Milwaukee, Wis., and author of the *Text in Pattern-making*, published by The Bruce Publishing Co., Milwaukee, Wis., was elected honorary member of the International Mark Twain Society.

♦ John E. White, printing instructor, Pittsburg, Kans., attended the American Municipal Association Meeting in Washington, D. C., December 4, 5, and 6. He was a delegate from Pittsburg, Kans., representing the City Council of which he is a member.

♦ Arnold Schultze has replaced Verne Thomas as day trade auto-mechanics instructor at K.S.T.C., Pittsburg, Kans. Mr. Schultze was in partnership with his father in a Pittsburg garage.

♦ Henry A. Loatz received the doctor of philosophy degree from the Ohio State University, Columbus, Ohio, at the spring commencement on June 9, 1950, in industrial-arts education. The dissertation title was "A Program of Industrial Arts for the Preparation of Elementary

(Continued on page 28A)

Fair weather ... or foul?

No matter what the future may bring, the most important single thing to the student of today is the development of skill. Not only will it make a difference in his success in peace time . . . but, what he learns today may well be the thing that saves his life and that of his country tomorrow.

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GENERAL ELECTRIC

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PERSONAL NEWS

(Continued from page 26A)

Teachers at the Ball State Teachers College, Muncie, Ind."

♦ Joseph Bossom, Victor J. Faggella, Alexander Lazar, Arnold Neil Penenberg, and Raymond David Roth, all at the New York University, School of Education, have been awarded the Edgar Starr Barney Memorial Scholarships in Industrial Arts for the academic year 1950–51.

♦ Berry E. Morton received his doctor's degree in industrial education from the University of Missouri in June and is now a member of the industrial education Department of the Indiana State Teachers College, Terre Haute, Ind.

♦ Ralph K. Nair of the Santa Barbara State College, University of California, completed his work for the doctor's degree in industrial education at the University of Missouri in June and was a member of the graduate faculty at Kansas State Teachers College during the 1950 summer session. He will return to his regular position at Santa Barbara in September.

♦ W. E. Lowry resigned from the position of assistant commissioner for vocational education and rehabilitation with the Texas Education Agency to accept an appointment as executive assistant to the president and dean of the School of Education of Sam Houston State Teachers College in Huntsville, Tex.

♦ Alfred P. Smith, supervisor of industrial arts in Indianapolis, Ind., was guest professor at Indiana State Teachers College, Terre Haute, during the past summer.

He taught industrial-arts design, industrial arts for elementary teachers, and two courses in woodwork.

Mr. Smith received both his B.S. and M.S. degrees from Indiana State Teachers College.

♦ Donald L. Davis, University of Minnesota, July, 1948, has accepted the position of general shop instructor at Clear Lake High School, Lakeport, Calif. He will introduce a new phase of shopwork at Clear Lake, the former shop having been limited to agricultural mechanics.

♦ Fred W. Eberle, for the past four years, State Teacher Trainer for Trade and Industrial Education, was appointed state supervisor, trade and industrial education, by the West Virginia State Board of Vocational Education, to succeed William A. Williams, who resigned to accept the assistant professorship of industrial education, The Pennsylvania State College.

♦ Charles R. Hill of Whitewater, Wis., received his doctor's degree in industrial education from the University of Missouri in August and is now a member of the industrial education staff at the University of Ill.

♦ Albert F. Kacillas of New Britain, Conn., was appointed teacher of industrial arts in the Public School System in Stafford, Conn.

Mr. Kacillas is a 1950 graduate of the Teachers College of Connecticut having attended the University of Connecticut for his first two years of college work.

♦ John Robert Valli of East Hampton, Conn., was appointed instructor of industrial arts at Lebanon, Conn. He is a graduate from Teachers College of Connecticut at New Britain. He has spent three years in the U. S. Navy and has had two years of industrial experience.

♦ Ralph E. Weeks, chairman of the board of the International Textbook Company and its wholly owned subsidiary, the International Correspondence Schools, died September 28, 1950.

Mr. Weeks was born in Skaneateles, N. Y., and after being graduated from high school, moved to Scranton. He started as an assistant bookkeeper for a local firm at the age of 17. Seven years later he was president of the concern. By 1913 he was head of the Scranton Board of Trade. In that same year he took over as president of the correspondence schools. He retired last year.

♦ Mitchell Bassin has been appointed assistant director of the Maryland School of Building Trades, Inc., Baltimore, Md.

♦ Dr. Verne C. Fryklund, president of The Stout Institute, Menomonie, Wis., has returned from Washington, D. C., where he was one of 400 college presidents who attended a two-day conference on higher education in which the educators advised and conferred with federal officials concerning military man power and research problems.

♦ Dr. Edwin R. Whitehead, director of electrical engineering at Illinois Institute of Technology, has been reappointed to the Illinois Professional Engineer Examining Committee for a three-year term.

He has served as a member of the committee for the past two years.

A native of Ash Grove, Mo., Dr. Whitehead received his bachelor's degree in 1928 at the University of Colorado, and his master's in 1935, and doctor's in 1944, both from the University of Pittsburgh.

♦ Armand Hofer and Dale Grout, Northwest Missouri State Teachers College graduates, are teaching in the industrial-arts department of the St. Joseph Public Schools, St. Joseph, Mo.

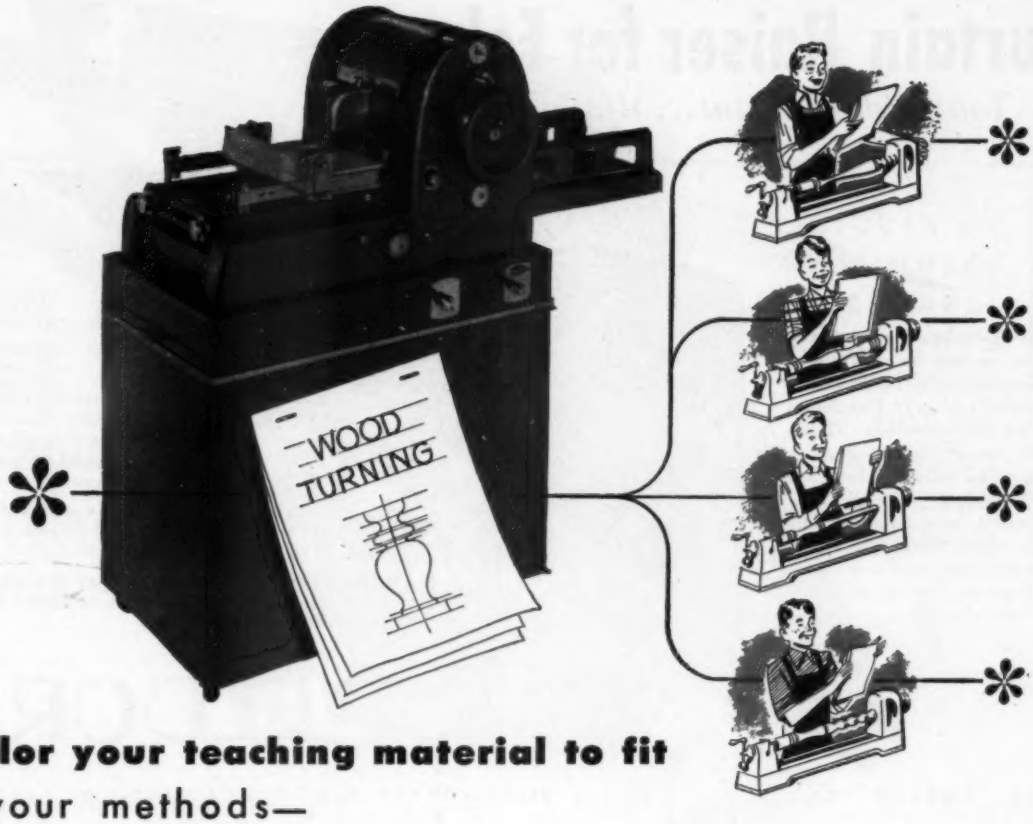
♦ John Russell, a graduate of Northwest Missouri State College the past year, is teaching industrial arts in the public schools at Maitland, Mo.

♦ L. E. Northrup, Veterans' Administration Training Officer, stationed at the Ranken School in St. Louis, died of a heart attack on August 20, after being ill for several months.

♦ Albert Cardot, director of vocational and industrial education for the Springfield Public Schools, Springfield, Mo., passed away suddenly the latter part of June.

♦ George H. Nelson has been appointed instructor of auto mechanics at the Senior High School, Springfield, Mo.

♦ Harold F. Glenn has been employed as machine-shop instructor for the Hannibal Vocational School, Hannibal, Mo.



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News Notes

♦ A reference guide for management, labor, and community leaders who face the problem of finding, placing, and using the man power needed for production of goods advantageously, has just been made available to the public by the New York State School of Industrial and Labor Relations at Cornell University.

The guide consists of a 17-page listing of selected references on the following topics: manpower mobilization; mobilization of teen agers, minority groups, women, the handicapped, and part-time workers; reducing accidents and improving safety; increasing man hours worked; cutting down absenteeism, increasing productivity and individual efficiency.

Copies of this guide are available free of charge from the Distribution Center, Cornell University School of Industrial and Labor Relations, Ithaca, N. Y.

♦ The nation's blinded World War II veterans have entered nearly every major occupational field at which Americans earn their living, from acting to teaching and from baking to cabinetmaking.

The survey — a breakdown of 448 veterans in training and 556 holding jobs at the end of 1949 — showed most of the veterans in jobs which bring them in contact with the sighted world. Relatively few went into specialized occupations for the blind.

♦ All types of projects are eligible in the 1951 Industrial Arts Awards. Nine major divisions and an open division assure every student who enters a project a chance to win a cash award and certificate.

Here are the divisions, the classifications under each one, and the groups under each classification:

Group I — 7th and 8th grades
Group II — 9th and 10th grades
Group III — 11th and 12th grades
Group IV — vocational students who spend more than 10 hours per week in subjects represented by their entries.

Wrought Metal — wrought copper and brass — wrought aluminum — wrought iron — awards in groups I, II, and III.

Patternmaking and Molding — patternmaking — awards in groups III and IV. Molding — awards in groups II, III, and IV.

Machine Shop — benchwork — awards in groups II and III. Machine work and machine construction — awards in groups II, III, and IV.

Wood — general woodworking — awards in groups I and II. Furniture making — awards in groups III and IV. Wood turning — awards in groups II and III.

Plastics — Carving — awards in group III — fabricating — awards in groups I, II, and III.

Electrical — radio — awards in groups II, III, and IV. Electrical devices — awards in groups I, II, III, and IV.

Mechanical drawing — general mechanical drawing — awards in groups I and II. Detail and assembly drawings — awards in groups II and III. Advanced detail and assembly drawings — awards in groups III and IV.

Architectural drawing — architectural working drawings and architectural presentation drawings — awards in groups III and IV.

Printing — single impression letterspress printing and letterpress printing in two or more colors — awards in groups II, III, and IV.

For further information address *Ford Motor Co., Industrial Arts Awards, 3000 Schaefer Road, Dearborn, Mich.*

♦ Veterans who undergo advisement and guidance at Veterans Administration are given up-to-date information on employment prospects in the light of the nation's defense needs, based on a check list recently distributed to V-A field offices.

The list includes nearly 100 essential occupational fields. In case America launches a full-scale mobilization of man power, these fields either would need large numbers of new workers or additional trained personnel just to maintain effective employment levels.

The list will help a veteran choose between an objective that best serves the national defense interests and one that does not — when his capabilities would be equally suitable to both.

♦ "Speaking of Safety," a new series of six training films showing supervisors and foremen how to address and conduct meetings, has just been announced by the National Safety Council, 425 North Michigan Ave., Chicago 11, Ill.

Film No. 1 in the series is "The Power of Speech." Film No. 2: "Butterflies in Your Stomach," explains physiological reactions that cause stage fright and shows how to overcome them.

Film No. 3: "The Key to Good Speaking." Film No. 4: "On Your Feet," explains what to do physically when making a talk.

Film No. 5: "Now You're Talking," discusses actual speechmaking.

Film No. 6: "Ring the Bell," shows how to get and hold the attention of an audience, and how to illustrate a point by telling a personal experience, humorous story or by comparisons, models or mock-ups, films, still pictures, graphs, charts, and diagrams.

The films are standard, 35mm. sound slide, with 16-in. records, 33⅓ r.p.m. About 13 minutes is required for each.

♦ Armour Research Foundation of Illinois Institute of Technology is offering a number of industrial research fellowships in physics, chemistry, metallurgy, ceramics, mechanics, and electrical engineering to begin in September, 1951.

Those persons awarded fellowships will attend

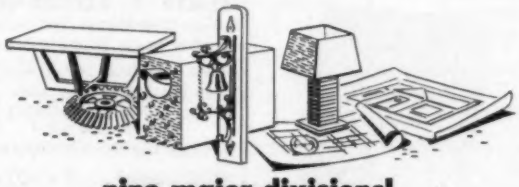
(Continued on page 33A)

WRITE for this FREE HANDBOOK of 1951 RULES and AWARDS...

...PICTURES OF 1950 WINNERS ...VALUABLE BACKGROUND INFORMATION ...FULL DETAILS OF THIS YEAR'S PROGRAM

who is eligible to enter?

Boys and girls in the 7th through 12th grades in *any* type of school (public, parochial, private) are eligible. MUST be enrolled in at least one shop or drawing course. There is no entry fee.



nine major divisions!

Major divisions include wrought metal . . . pattern-making and molding . . . wood working . . . electrical . . . mechanical drawing . . . architectural drawing . . . machine shop . . . plastics . . . printing.

plus new "open" division!

For 1951, there is a new "open" division for any I.A.A. projects not covered in the major divisions. Each division includes a number of classifications further divided according to grade levels.

cash awards, all-expense trips to Detroit and Dearborn!

Regional winners will receive cash awards plus emblem pins and (for all except "open" division entries) a chance to win national prizes including expense-paid trips to Dearborn and Detroit for student winners *and their instructors.*

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NEWS NOTES

(Continued from page 30A)

Illinois Institute of Technology half time and work in the Research Foundation half time in a graduate program leading to advanced academic degrees. They are employed full time by the Foundation during the summer.

Application forms may be obtained from the Office of Admissions, Graduate School of Illinois Institute of Technology. Applications received prior to March 15 will be given first consideration.

♦ The United States Civil Service Commission has announced examinations for Intelligence Research Specialist, Military Intelligence Research Specialist, and Foreign Affairs Officer to fill positions paying fom $3,825 to $6,400 a year in various federal agencies in Washington, D. C., and vicinity. The majority of the positions are in the Departments of Defense, Army, Navy, Air Forces, and State.

Information and application forms may be obtained from most first- or second-class post offices, from civil service regional offices, or from the United States Civil Service Commission, Washington 25, D. C. Applications for these positions will be accepted by the Commission's Washington office until further notice.

♦ Four new bulletins describing General Electric's a.c. and d.c. rotating machines for school laboratories have been announced by the Educational Section of the Company's Apparatus Department at Schenectady.

Nineteen motor generator sets for instructional purposes have been grouped into four broad classifications to assist in the selection of additional equipment for technical schools and colleges.

Quick evaluation of the suitability of these sets for each school's particular needs can be made more easily and more accurately through the use of the new bulletins.

The bulletins are GEC-743, motor-generator sets for the study of d.c. machines; GEC-744, motor-generator sets for the study of synchronous machines; GEC-745, motor-generator sets for the study of a.c. motors; and GEC-747, d.c. exploring coil sets for oscillograph studies in d.c. armatures.

The new illustrated bulletins are available to all readers of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION by writing to the *General Electric Co., Schenectady 5, N. Y.*

New Publications

TV and Other Receiving Antennas

By Arnold B. Bailey. Cloth, 606 pp., 5¾ by 8½ in., illus., $6. John F. Rider Publisher, Inc., New York 13, N. Y.

The author presents the subject matter in 12 chapters in which he gives a review of definitions and terminology, describes the television signal and its band width, takes up problems of television reception, explains the electromagnetic wave and radio path, and thoroughly pictures center-fed half-wave antennas, parasitic-element antennas, horizontally polarized antennas, and vertically polarized and special antennas.

Chapter 12 is devoted to practical aspects of TV receiving antennas.

A set of review questions are provided for each chapter.

Drafting Simplified

By Elmer A. Rotmans. Cloth, 397 pp., 8 by 10½ in., illus., $3.75. Delmar Publishers, Inc., Albany 1, N. Y.

A text for the beginning draftsman whether he be at school, under an instructor, or whether he is using the book for individual home study.

The material is divided into 16 separate units, which are all presented in clear step-by-step explanations.

The author also has prepared four workbooks which may be used as companion books to the text. A teacher's key also is obtainable.

Workbook I contains 33; Workbook II, 34; Workbook III, 35; and Workbook IV, 41 drafting plates.

The textbook, therefore, represents a complete drafting course for students of junior high, senior high, technical high, and full-time and part-time vocational schools.

Vocational Education: America's Greatest Resource

By John A. McCarthy. Cloth, 397 pp., 5¾ by 8½ in., illus. American Technical Society, Chicago, Ill.

This book was prepared by an expert in the subject to show laymen, members of school boards, manufacturers, members of unions, teachers, supervisors, and school administrators what the principles and philosophies of vocational education really are.

The fifteen chapters into which the book is divided give a broad general picture of the beginnings of vocational education, the struggle for federal aid, the Smith-Hughes Act and additional acts for federal aid, the growth of vocational education because of the federal aid given, how to set up a good program, how to determine and meet the needs, how to set up the proper content and apply suitable methods, the relationship between vocational education and life adjustment, and what the future has in store for vocational education, or vice versa.

Course of Study Construction

By G. Harold Silvius and Jack R. Slagle. 66 pp., 75 cents. Available from Wayne University Bookstore, 5000 Cass Ave., Detroit, Mich.

(Continued on next page)

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NEWS NOTES

(Continued from previous page)

This syllabus is intended to serve as a teacher's guide for writing courses of study. It is designed to aid a teacher meet his individual situation. Topics dealt with are: Philosophy and Aims of General Education; Concepts of Vocational Education; Administration of Vocational Education; Testing and Evaluation; Physical Plant Planning; and a suggested outline for a course of study. The material is presented by concrete examples as well as in theory.

Automotive Engines — Maintenance and Repair

By Irving Frazee, Earl L. Bedell, and Ernest Venk. Cloth, 381 pp., 5¾ by 8½ in., illus., $4.50. American Technical Society, Chicago, Ill.

This book is the result of a four-year long, industry-wide research on the training of auto mechanics.

Its eight chapters present thorough explanations of the operating principles of gasoline and Diesel engines; show how to clean and measure the working parts; disassemble and remove the engine, cylinder heads and oil pans, cylinder block and crankcase, crankshaft and flywheel, pistons and connecting rods, valves and valve-operating mechanisms; overhaul lubricating and cooling systems; fit and remachine parts that require this service; and reassemble everything preparatory to return the engine to service.

Problems in Architectural Drawing

By Franklin G. Elwood. Cloth, 160 pp., 7¾ by 10 in., illus., $2.80. Chas. A Bennett Co., Inc., Peoria, Ill.

This revised edition of a text written by a registered and supervising architect, who also is head of a department of architectural drawing, presents in a simple and compact form valuable material which will be found useful by the student as well as by builders and mechanics who wish to learn how to make architectural drawings.

Besides presenting material on design and execution, there are chapters on carpentry and masonry construction, and a good, although brief, description of stock, materials, and problems on strength calculations.

The book also contains useful tables on designing data, and a goodly number of drawing and designing problems, varying from small simple structures to making plans for ranch type and Cape Cod and other houses.

The book also contains a glossary of trade terms.

Problems in Industrial Teaching

Compiled and edited by G. Harold Silvius and Clarence W. Phillips. 118 pp., $1.34. Available from Wayne University Bookstore, 5000 Cass Ave., Detroit, Mich.

This book is a study guide for teachers of industrial education, covering 28 units based on the activities of industrial education teachers.

Boats, Airplanes, and Kites

By Armand J. LaBerge. Paper cover, 135 pp., 7½ by 9¾ in., illus., $2.50. Chas. A. Bennett Co., Inc., Peoria, Ill.

This is a revised edition of a book which has given pleasure to many youngsters interested in model boats (sail and motor), model airplanes, and kites.

The descriptions accompanying the half tones and working drawings are brief and to the point, and the illustrations are uniformly good.

Machine Shop — Theory and Practice

By Albert M. Wagener and Harlan R. Arthur. Cloth, 306 pp., 7¾ by 10½ in., illus. D. Van Nostrand Co., Inc., Publishers, New York City.

This is the second edition of this text which has helped to train many machinists and toolmakers.

It is divided into 19 chapters in which are covered the measuring tools; power tools such as shapers, planers, lathes, milling machines, cylindrical and surface grinders; tool and cutter grinders; bench tools; routing and inspection; benchwork; and heat treating.

The book also contains a number of useful formulas and tables.

A revised edition of a workbook to accompany this text also is available.

The Counseling Interview

By Clifford E. Erickson. Cloth, 174 pp., 5¼ by 8½ in., $1.75. Prentice-Hall, Inc., Publishers, New York City.

This book presents practical suggestions that every interviewer can use. It shows how to plan, begin, analyze, and conclude an interview, and offers specific suggestions for conducting every phase of such an interview.

An entire chapter is devoted to the step-by-step development of a counseling program. Another chapter of case material provides a basis for discussion and application of interviewing techniques. The final chapter offers suggestions for evaluating the interview.

How to Pass College Entrance Tests

By Allison Peters. Cloth, 188 pp., 8⅜ by 10¼ in., $2.50. Arco Publishing Co., New York 17, N. Y.

This book presents the preparation required by high school seniors and others who are planning to take college entrance mental and psychological tests.

It describes the tests given by each American college and university, and provides study material, practice questions and answers for all of them.

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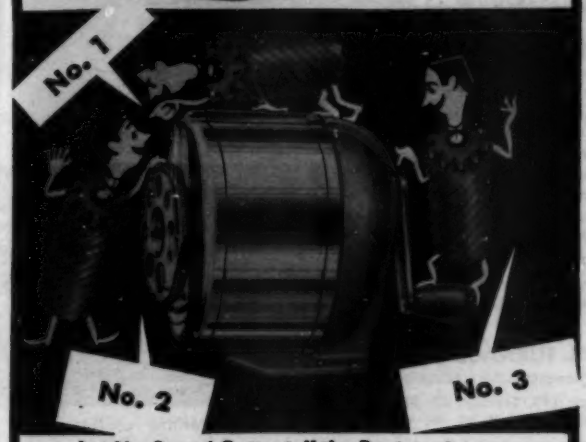

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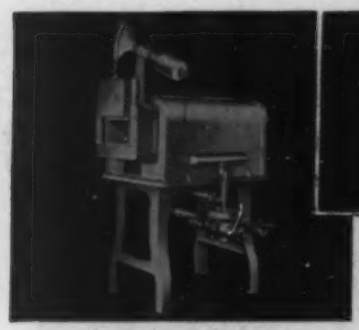

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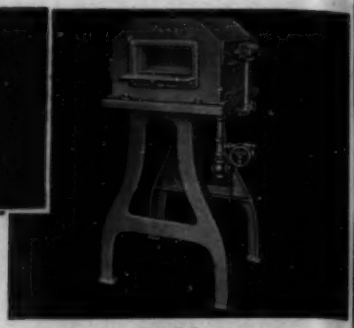

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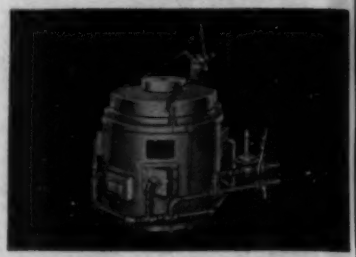

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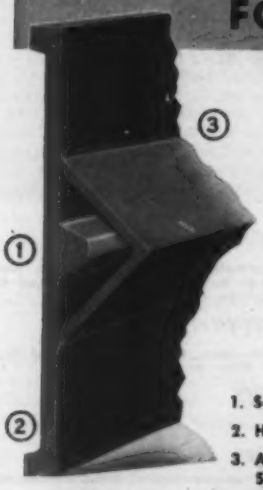

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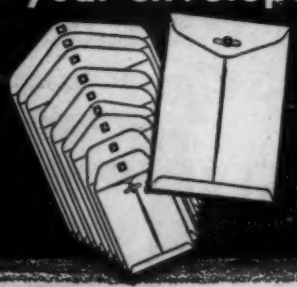

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SHOP EQUIPMENT NEWS

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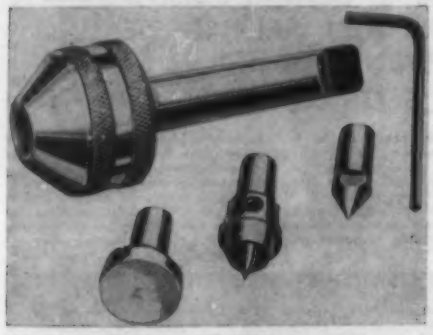
Tests of the No. 1490 Delta ball bearing center demonstrated that it outlasted four similar units, according to engineers of the Delta Power Tool Division, Rockwell Manufacturing Company, Milwaukee 1, Wis.

The center, because of its husky, simple construction, is free of chatter. It has a double row of sealed, lubricated-for-life ball bearings, to take exceptionally heavy radial and thrust loads. It is



No. 1490 ball bearing center

accurate and runs true, because the center socket is drilled and machined after assembly.

The Delta ball bearing center is especially suitable for school shops where it eliminates the use of oils and waxes and leaves no scars or burn marks on the work being turned. The unit is supplied with three replaceable centers and a wrench. The shank has a No. 2 Morse taper.

Further information can be obtained from Delta dealers, or by writing direct to the company.

For brief reference use IAVE—0201.

BLACK & DECKER SUPER-SERVICE VALVE REFACER

Newly designed Super-Service Valve Refacer has been introduced by The Black & Decker Mfg. Co., Towson 4, Md. A wet-grinding Refacer, it supersedes all previous Black & Decker models.

The outstanding feature of the new Deluxe Super-Service Refacer is that it will traverse grind all valves from 0 to 90 deg.

It handles valve stems from 5/32 to 11/16 in. and has a valve head capacity up to 4 in. in diameter. The wheel head is at a 20-deg. offset permitting traverse grinding of any angle valve face including the flat type.

The work head is hypoid gear driven eliminating belts, vibration, and chatter. The machine is supplied with two collets (capacity 5/32–9/16 in. and 1/2–11/16 in.) and a hand wheel on the back of the work head has a double lead thread for giving quick clamp action on the stem in the collet.

Super service valve refacer

For further information address *The Black & Decker Mfg. Co., Towson 4, Md.*

For brief reference use IAVE—0202.

DI-ACRO PUNCH NO. 2

The new Di-Acro Punch No. 2 has a depth of throat of 12¼ in., and a height of throat of 3 13/16 in.

In addition to its ability to perforate holes of various shapes and sizes as large as 4 in. in diameter it can also be employed as a precision punch press for an unlimited variety of blanking, drawing, embossing, and forming operations.

The powerful action of this machine is obtained through a roller bearing which converts a small amount of operator effort into a tremendous pressure of the point of impact.

Di-Acro punch No. 2

It has a triangular shaped ram which is hardened and precision ground. Since turning or twisting of this triangular ram is impossible, the position of the punch head is in alignment at all times.

The flexible gauging arrangement built into the Di-Acro Punch No. 2 can be adjusted to provide precision location of the material for exacting operations. A wide variety of readily interchangeable punches in round, square, oval, and rectangular shapes are available.

Although the Di-Acro Punch No. 2 has been primarily designed for short run operations, it is often practical for production quantities in lightweight materials where a hand-operated machine can be employed more effectively than a power unit.

For further information address *O'Neil-Irwin Mfg. Co., 351 Eighth Ave., Lake City, Minn.*

For brief reference use IAVE—0203.

NEW PROTO THIN-WALL HEX SOCKETS

Addition of twenty single-hexagon (6-point) thin-wall socket wrenches to the PROTO line has been announced by the Plomb Tool Company, Los Angeles, Calif. Having thin walls, these sockets can be used in restricted areas — wherever corresponding double-hexagon (12-point) types will fit. Although thinner than regular power sockets, the new designs are guaranteed for power or hand use in service work.

Single hexagon sockets are particularly useful because they safely fit and turn undersize nuts,

Proto-thin wall sockets

as well as those that are rusted or damaged. They permit safe work on stubborn nuts without danger of slipping, and they do not chew up brass or other soft nuts. Hex sockets are stronger than 12-point types and therefore wear longer.

They are made of special alloy steel, and have a lustrous chrome finish.

Seven of the twenty additions are 5/16-in. drive regular sockets with openings of 5/16 to 11/16 in. Six are 3/8-in. drive extra deep sockets with 3/8- to 11/16-in. openings. Seven are 1/2-in. drive regular sockets with 9/16- to 3/4-in. openings.

For further information write to *Plomb Tool Co., Los Angeles, Calif.*

For brief reference use IAVE—0204.

KNIGHT VTVM KIT

A new Knight low-cost, easy-to-build Vacuum Tube Voltmeter kit, ideal for school lab classes, has been announced by the Allied Radio Corpo-

Vacuum voltmeter kit

ration. The kit is designed for versatility, and includes 4 milliampere ranges and 6 capacity ranges, in addition to 20 standard VTVM ranges. It thus serves to teach the student all constructional and operating details of a VTVM, and at the same time, the completed unit may be used

(Continued on page 40A)

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The HOTPACK PLASTIHEETER is a commercial type strip heater designed to heat sheets of Plexiglass or Lucite until they become soft and pliable for shaping to the form desired. It is essentially used for straight line bends or folds and is capable of heating sheet material up to ½" thickness in from 30 seconds to 4 minutes depending on the thickness of the material. As the material does not come into contact with the heating element and the platen remains cool, there is no possibility of creating mark-off on the sheet.

SPECIFICATIONS

Model No.	Working Space	Overall-Size
15	18"Lx3"Wx2½"H	21"Lx7"Wx3½"H
16	30"Lx3"Wx2½"H	32"Lx7"Wx3½"H

Wattage 115 Volt	Shipping Weight	Price
200 W	4 lbs.	$15.00
350 W	6 lbs.	25.00

THE ELECTRIC *Hotpack* COMPANY, INC.
5067 Cottman Ave. Philadelphia 35, Pa.

SHOP EQUIPMENT NEWS

(Continued from page 38A)

in the lab for all testing applications requiring a VTVM or a VOM.

Step-by-step instructions are furnished, including schematic and pictorial diagrams.

The Knight VTVM has 30 ranges in all, and special probes are available for extending the d.c. range to 30,000 volts, and for extending the a.c. range to read RF to 100 megacycles.

A 4½-in. meter is used, with matched-pair resistors for high accuracy. Has zero-center d.c. scale for use in FM discriminator alignment, and pilot light for off-on indication. The professional-looking all-steel case is finished in Hammertone gray, and is 10 in. high, 6 in. wide, and 5 in. deep.

For further information write to the *Allied Radio Corp., 833 W. Jackson Blvd., Chicago, Ill.*

For brief reference use IAVE—0205.

LYON STEEL SHOP BOXES

Lyon Metal Products, Inc., manufactures a complete line of steel shop boxes.

Lyon steel shop boxes

These boxes are available in five different styles. Illustrated is the Style RB shop box which can be stacked on the floor and used for regular bin type storage. Hopper end permits easy removal of contents from boxes even when stacked. The front top rail is rounded for use as a handle. The opposite end has a drop handle. Size: 10 in. wide, 20 in. long, 8 in. high. Available with green finish or without any finish.

Lyon shop boxes eliminate fire hazards; they will not absorb oil or grease, and they will not warp, rot, shrink, or splinter.

For further information write to *Lyon Metal Products, Inc., Aurora, Ill.*

For brief reference use IAVE—0206.

CERTIFIED THERMOMETER TESTING SET

The Tagliabue Instruments Division of Weston Electrical Instrument Corporation has recently introduced a set of nine matched thermometers with overlapping ranges, available either in Centigrade or Fahrenheit scales. They were developed to provide relatively inexpensive but extremely accurate temperature measuring instruments for engineers, scientists, and technicians.

These thermometers are known as the Tag-A.S.T.M. Certified Thermometer Testing Set. They meet all the specifications of the American Society for Testing Materials and other official testing agencies covering accuracy, dimensions, and performance for thermometers of this type. Inclusive ranges of each set are: Fahrenheit, minus 36 degrees to plus 760 degrees; Centigrade, minus 38 degrees to plus 405 degrees. Calibrations are in 1/10, 1/5, and ½ a degree Centigrade; 1/6, ½, and 1 degree Fahrenheit, with each ther-

(Continued on page 41A)

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Size	Each
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12" dia....	50¢
14" dia....	60¢
16" dia....	80¢
18" dia....	95¢
20" dia..	$1.10

14 Gauge (.064")

Size	Each
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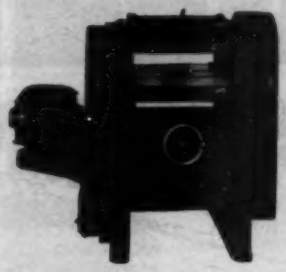

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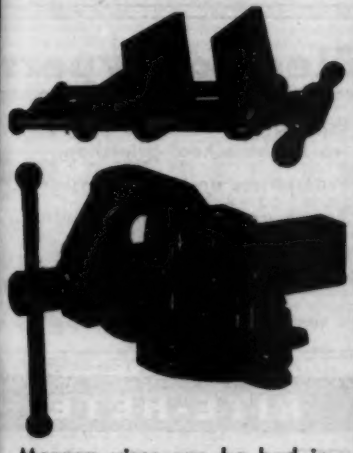

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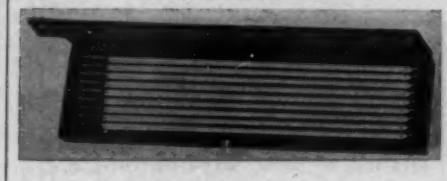
SHOP EQUIPMENT NEWS

(Continued from page 40A)



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mometer accurate to within one scale division. Each thermometer is furnished with a *Tag* test room certificate of accuracy, listing compensations for individual scale characteristics.

For further information write to Tagliabue Instrument Division of *Western Electrical Instrument Corp., 614 Freylinghuysen Ave., Newark, N. J.*

For brief reference use IAVE—0207.

PORTER-CABLE BUYS JOHNSON CORPORATION

The Porter-Cable Machine Co. has purchased the Johnson Engineering and Sales Corporation of Rockford, Ill.

The Johnson Corporation manufactures air-driven sanding machines. These sanders will become a part of Porter-Cable's Speedmatic line of electric tools which includes saws, abrasive belt sanders, routers, shapers, planers, and lock mortisers. The firm also manufactures a line of Guild homecraft tools, floor sanding machines, and industrial abrasive belt grinders.

Air-driven sander

The Johnson air-driven sander, available in two models, is a two-pad opposed reciprocating sander used for fine finishing and rubbing. It is operated pneumatically and is completely safe when used in shops and plants where flammable coolants or fluids are used.

Complete information on the sander may be obtained by writing to *The Porter-Cable Machine Co., Syracuse 8, N. Y.*

For brief reference use IAVE—0208.

NEW SHOPSMITH CATALOG

Shopsmith announces the new Handyman Catalog. This catalog presents a full explanation of Shopsmith and its applications.

This new power tool is designed for multiple uses. It converts quickly into an 8-in. circular saw, 33-in. wood lathe, 12-in. disk sander, 15-in. vertical drill press, and horizontal drill press.

For a free copy of the new catalog write to Shopsmith, Dept. 201 S, 12819 Coit Road, Cleveland 8, Ohio, or 417 Montgomery St., San Francisco 4, Calif.

For brief reference use IAVE—0209.

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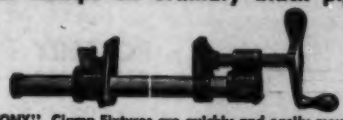

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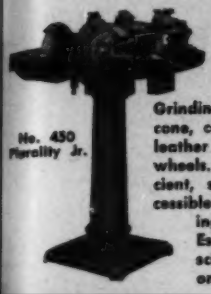

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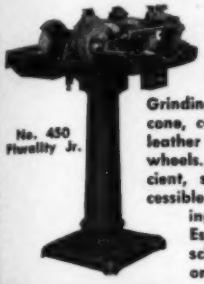

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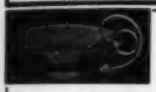

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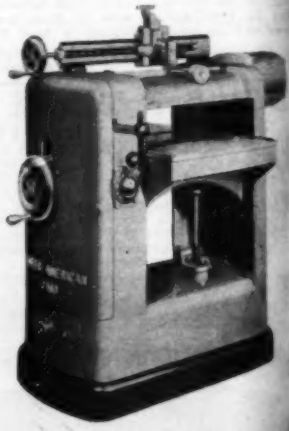

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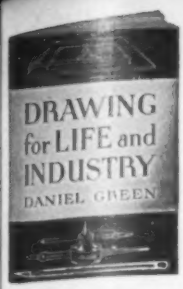

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